N.A. WAKEFIELD

Handbooks of the Flora and Fauna of South Australia, issued by the British Science Guild (South Australian Branch) and published by favor of the Honorable the Premier.

THE MAMMALS

OF

SOUTH AUSTRALIA.

By FREDERIC WOOD JONES, D.Sc.

Part III.

(CONCLUSION)

CONTAINING

The Monodelphia.

WITH ILLUSTRATIONS.

Price: FIVE SHILLINGS.

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Presented to Norman Hapgood.
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assistance to the Club, and in recognition.
(1902)

NOTE.

In Part II. at page 175, the sub-specific name for the South Australian Ring-tailed Opossum is given as *notilis ;* this should read *notialis* throughout the account.

Since Part III. was completed and in the press, a new species of Dormouse Opossum (*Dromicia britta* Wood Jones, 1925) has been obtained from Millicent in the South-East, and a new native rat (*Pseudomys* (*Leggadina*) *messorius* Thomas, 1925) has been found by the writer in the Northern portion of the State. The descriptions of these new species cannot be included, but the fact of their recent discovery should act as a stimulus to South Australian zoologists to continue the work of investigating the mammalian fauna of our State.

Sub-Class III.—MONODELPHIA.

PLACENTALIA or EUTHERIA.

There are many people in Australia who suppose that all truly indigenous Australian mammals are either pouched Marsupials (Didelphia) or egg-laying Monotremes (Ornithodelphia). It is quite common to hear this opinion expressed by people who are not otherwise to be classed as uninformed; for in some peculiar way it has become quite a belief in Australia that the hall mark of a truly native Australian mammal is the possession of a pouch. Quite apart from the fact that all marsupials are not "pouched" animals, there are the two great outstanding facts that all native Australian mammals are *not* marsupials and all marsupial animals are not Australian. It is a popular error to suppose that all indigenous Australian animals are marsupials; it is a popular prejudice, and a still greater error, to suppose that all marsupial animals are confined to Australia. Many people are surprised to learn that there are well over a hundred species of mammals which are truly Australian and which are not marsupials, and that there are some ninety species of marsupial animals which are not Australasian.

The interest attached to the Didelphian inhabitants of Australia has, as a rule, appealed to the naturalist so strongly that he has neglected to pay much attention to the indigenous non-marsupial mammals. The truly Australian Monodelphian or higher mammals are, therefore, a rather neglected set of creatures, and it must be owned that this is all the more regrettable since they form a group which for scientific and economic reasons is worthy of all the study and attention that our field naturalists can devote to it. It is well to make this fact clear at the outset, since Lucas and Le Souef have written the following in a standard work on the Australian mammals:—"With the exception of the Australian Water-Rats, and the more closely allied genera, none are of any special interest, while not a single species is of any commercial value whatever." The average Australian realises that there are rats out in the bush and bats around his home; he knows that there are seals upon the coast; but the rats and bats he is inclined to regard indiscriminately as introduced pests and the seals as castaways from which pelts may be obtained. Of the life histories of the indigenous rats we know very little, of the bats practically nothing, and of the seals only the reports of the few who have visited them in their island haunts with the intention of observing and not murdering them. It is not, as a rule, realised that the native rats of Australia are a peculiar Australian specialisation and that they are ancient inhabitants of the land. From pure tradition the Australian may feel a patriotic interest in the kangaroo (even though he is the while permitting its certain and legalised extermination), but it would be difficult to find the Australian prepared to manifest any national pride in his wonderful native Water Rat (*Hydromys*), his House-building Rats (*Leporillus*), or his Jerboa Mice (*Notomys*), though these creatures are typically and

peculiarly Australian. The commonest bat that flies around our houses, that lives in our suburbs, in our gum-tree flats, in the mallee and in the mulga of the Centre, is a pure Australian specialisation. The genus *Nyctophilus* was created for the Australasian Long-eared Bats which live nowhere else in the world. The magnificent hair seal which inhabits the islands of the Great Australian Bight lives only on these islands, and certain groups lying off the coast line of Western Australia. It is a peculiarly Australian animal, and even on the coasts of Australia its distribution is extremely limited.

Let us remember, then, that among the rats, the bats, and the seals we have animals as truly Australian, and as worthy of Australian national pride as the kangaroo and wombat. Let us remember that the protection of "native" animals should not only apply to the marsupials, but that it ought to be extended to those Monodelphians which, for the most part, leading harmless lives, and being typical Australian products, are deserving of all the protection that legal enactments can give them.

As we have seen already (Part I., p. 84) the whole of the animals comprised within the Sub-class Didelphia are so similar in their general characteristics that they may all be properly classed within the single Order of the Marsupialia. With the Sub-class Monodelphia it is very different. The types embraced within the limits of this Sub-class are so diversified that many Orders have to be created for the reception of the widely sundered types. All of the many Orders of the Monodelphia are not represented in the mammalian fauna of Australia, and some which have representation in Australia are without members in the fauna of South Australia. Of the great assemblages of Monodelphian mammals unrepresented in Australia we may cite the *Insectivora*, the *Carnivora* and *Ungulata* (save for human introductions), the *Edentata*, and the *Primates*. Of the Orders which, though represented in Australia, have no member in South Australia, we may instance the *Sirenia*, the Order to which the well known dugong of Queensland belongs.

The neglect of the Australian Monodelphian mammals by Australian zoologists is regrettable, and past neglect is difficult to remedy by present enthusiasm, since the collections of study material preserved in Australian Institutions are so inadequate. Nearly all the type specimens of the properly described species are lodged in European Museums, whilst many of those of the older and less defined species are lost. The naming of Australian rodents and bats is, therefore, a peculiarly unsatisfactory and difficult business for local zoologists, and this state of affairs can only be remedied by enthusiastic collecting and careful preservation. In many cases this lack of properly named material has been felt keenly by the writer, and it may be that the publication of these handbooks will in some measure remedy this state of things by calling attention to the deficiencies in our State Museums. Many years of conscientious work will be needed to atone for the many past years of neglect.

Order CETACEA.

The truly aquatic Whales and Dolphins, which constitute the Order, are animals that have so wide a range of habitat that they cannot be claimed as the peculiar fauna of any one small portion of coast line. In dealing with this Order, therefore, the treatment will be rather in the form of a catalogue of those species which are known to inhabit, or to have recently inhabited, our shores, or which have been washed ashore on our coasts.

At one time whales were numerous around the coasts and islands of South Australia, and from Encounter Bay, the West Coast ports, and D'Estree Bay in Kangaroo Island an important and flourishing whaling industry was carried on. Relics of this industry, in the form of the large boiling-down pots—trypots—used by the whalers, are still to be found; and harpoons and lances are still treasured possessions of those who acquired them from a former generation. It is much to be hoped that these relics will ultimately be gathered together in the State Museum, so that we may have some permanent records of an industry and a phase of South Australian life and adventure that has been by no means adequately chronicled.

The whole Order Cetacea is very naturally divided into two Sub-orders, the one possessing teeth—*Odontoceti*, and the other being toothless in the adult state—*Mystacoceti*.

Sub-order I.—MYSTACOCETI.

The toothless whales are toothless only when adult, for teeth develop in the young animal, but are afterwards shed and replaced by the plates of baleen which constitute the commercial "whalebone."

The Whalebone Whales differ from the Toothed Whales, not only in possessing plates of baleen instead of teeth in the adult, but in many other additional characters. Of these other characters it is only necessary to mention a few. The skull is symmetrical, the maxillae do not overlap the frontal bones, and the two halves of the lower jaw meet in front over only a short distance, and are, as a rule, connected only by ligaments.

Four genera of Whalebone Whales are represented in South Australian waters. These genera are distinguished as follows:—

(A.) Dorsal fin absent. Genus 1. *Balaena*.

(A^1.) Dorsal fin present.

(B.) Without grooves on the throat. Genus 2. *Neobalaena*.

(B^1.) With grooves on the throat.

(C.) With short pectoral flippers. Dorsal fin triangular. Genus 3. *Balaenoptera*.

(C^1.) With elongated pectoral flippers. Dorsal fin rounded. Genus 4. *Megaptera*.

GENUS 1.—BALAENA (Linnaeus, 1735).

The genus contains the large whales, from 50 to 60 feet in length, which lack a dorsal fin. The head is very large, and the throat has no longitudinal furrows.

The members of this genus were known to whalers as "Right Whales," the term being applied to them since they were the right kind of whale from the whaler's point of view. Their baleen is finer and longer than that of the other whalebone whales and the oil is more abundant and of better quality. They were, therefore, the whaler's greatest prize and were the prime objective of his enterprises.

Southern Right Whale, Black Whale.

BALAENA AUSTRALIS (Desmoulins, 1822).

The Southern Right Whale ranges the whole of the oceans south of the Arctic Seas, and it was on its account that all the great southern whaling industries sprang into existence. From our waters it has almost entirely disappeared, and no whaling for Right Whales has been carried on from the various South Australian stations during the lifetime of the present generation. From the Greenland Whale or Northern Right Whale (*Balaena mysticetus*) it differs in having a smaller head—about one-quarter, instead of one-third, of the length of its body—and having

FIGURE 191.—Outline of *Balaena australis*. About $\frac{1}{200}$ natural size.

normally fifteen, instead of thirteen, pairs of ribs. (*See* Figure 191.) The baleen plates are about six feet in length, being shorter than those of the Greenland Right Whale.

In length the Southern Right Whale runs to about sixty feet, and in colour it is blackish-grey above and white beneath the throat and part of the ventral surface. By whalers its size was always estimated, not in length or girth, but in the number of barrels of oil it produced; and although it was formerly so extensively hunted along our coasts, we are very lacking in precise records of its size or its characters. No specimens appear to have been stranded or captured during the last half-century, and the skeleton is not represented in our State collections.

GENUS 2.—NEOBALAENA (Gray, 1871).

Of this genus there is probably only a single species. The characters of the genus are as follows:—

The skin of the throat is smooth and unmarked by longitudinal furrows. The head is not disproportionately large. The dorsal fin is present, and

it is small and sickle-shaped. There are seventeen pairs of ribs. The baleen plates are relatively very long, and it was upon the character of these plates, in the absence of any more definite information about the whale, that Dr. Gray separated it from its kin and created a new genus for its reception.

Pigmy Right Whale.

NEOBALAENA MARGINATA (Gray, 1866).

This little whalebone whale grows only to a length of about twenty feet, and of its total length its head constitutes about one-fourth. Its baleen plates are distinguished by being pale yellow in colour, and they are marked by a conspicuous blackish outer margin; it was on account of this black edge to the baleen that Dr. Gray named it *marginata*.

Of this species three specimens have been recorded as being stranded on the coasts of South Australia. The late Mr. A. H. C. Zietz, of the South Australian Museum, recorded in 1889 that "three individuals in the flesh have been received at the Museum, two from Kangaroo Island, and one very young animal from Encounter Bay." In the same communication Mr. Zietz also said:—"The external characters of this whale were unknown till the receipt of the specimens at the Adelaide Museum."

Writing in 1892, Ogilby notes that "although two fresh specimens have recently come ashore at or near Adelaide, South Australia, no measurements or description of the external characters appear to have been taken."

It is unfortunately too late to remedy this defect. Whatever observations Mr. Zietz may have made they do not appear to have been published. An excellent cast of the head was, however, prepared, and it, with the skeleton, is preserved in the State Museum, and replicas have been sent to other institutions.

GENUS 3.—BALAENOPTERA (Lacépède, 1804).

The members of this genus have the skin of the throat deeply furrowed by longitudinal grooves. The dorsal fin is small and sickle-shaped. The head is small, being less than a quarter of the length of the body. The fore limbs or flippers are short and narrow. The baleen plates are coarse and relatively short.

Members of this genus are known as Rorquals.

Blue Whale, Southern Rorqual, Finner, Finback, Sulphur bottom.

BALAENOPTERA MUSCULUS (Linnaeus, 1758).

This, the largest of the Rorquals, is here designated *B. musculus* in accordance with the finding of Dr. True that the name by which it has so commonly been known (*B. sibbaldi*) is a synonym. *Balaenoptera musculus* is the largest living animal, and, with very few possible exceptions, the largest animal that has ever lived. On account of its size,

its speed, and its great ferocity, it was no favourite of the old-fashioned whaler, especially as its baleen is of poor texture and only some two feet in length, and its blubber is small in quantity and poor in quality. In colour the back and sides are bluish when seen from some distance, the bluish tinge being due to lighter streaks and mottlings on the otherwise black skin. The animal is elongated and more graceful in build than the Right Whale, and is far faster in the water than its more commercially valuable relative. (*See* Figure 192.) On account of the sickle-shaped dorsal fin, which is lacking in the Right Whales, the Blue Whales or Rorquals have been termed Finners or Finbacks by the whalers.

Sixty or more folds mark the underside of the throat, which is coloured white or pale yellow. This whale, although but little accounted of in the

FIGURE 192.—Outline of *Balaenoptera musculus*. About $\frac{1}{340}$ natural size.

days of the Right Whales, was hunted by the South Australian whalers for some thirty years after the Right Whales had disappeared. On September 10, 1918, a fine specimen was stranded in Covisart Bay, near Streaky Bay. This animal when measured by Waite as it lay on the sand proved to be 87 feet 4 inches in length between a stake placed at its head and another placed between the flukes of its tail. The whole skeleton of this huge animal was fortunately preserved and is at present stored in our State Museum.

GENUS 4.—MEGAPTERA (Gray, 1846).

The only member of this genus has a dorsal fin which is not very prominent, numerous furrows below the throat, and extremely long pectoral flippers. The external form is ungainly, the animal lacks the more graceful lines of the *Balaenoptera*, and on account of this and the lowness of the dorsal fin, it is usually known to whalers as the "Humpback." Apparently only one very variable species of wide distribution represents the genus.

Hump-back Whale.

MEGAPTERA NODOSA (Bonnaterre, 1789).

In length this whale goes to over 50 feet, and it is known to whalers as a rather formidable animal, since it possesses extraordinary activity in leaping out of the water and striking with the flukes of its tail. The back and sides are usually black, the belly being almost pure white; but the

actual colouration is well known to whalers to be extremely variable, and but little reliance may be placed upon it in determining specific characters. The pectoral flippers are enormously long, being about one-fourth of the

FIGURE 193.—Outline of *Megaptera nodosa*. About $\frac{1}{200}$ natural size.

entire length of the head and body. (*See* Figure 193). A specimen of this whale was stranded at Corny Point, Yorke Peninsula, and its skeleton is preserved in the State Museum.

SUB-ORDER II.—ODONTOCETI.

The Toothed Whales embrace a wider variety of forms than does the assemblage of Whalebone Whales, for within the Sub-order are contained the great Sperm Whales, as well as the small Porpoises and Dolphins. They form a well-defined group, the true relation of which to the *Mystacoceti* is by no means clear. Whatever their relationship, they constitute a remarkable parallel series, with large forms, dwarf forms, forms with and without dorsal fins, and with long or short pectoral flippers and with throat grooved or plain, in both (toothed and toothless) sections.

True teeth, though they may be greatly reduced in number, are never absent; even in the Beaked Whales there are one or two pairs of teeth normally fixed to the lower jaw. Most of the *Odontoceti* show the curious condition of having a skull which is more or less asymmetrical, and in the Sperm Whales this lack of cranial symmetry is carried to such a high degree that only one nasal bone of the usual pair is present.

The maxillae overlap the frontal bones, and the two halves of the lower jaw unite in front by a definite symphysis and not by a mere fibrous union, as in the *Mystacoceti*.

Of the Sub-order, three families concern us, these families being distinguished as follows:—

(A.) Functional teeth present in the lower jaw only.

(B.) Mandibular teeth numerous.
Family I. *Physeteridae*.

(B¹.) Mandibular teeth reduced to one or two pairs.
Family II. *Ziphiidae*.

(A¹.) Functional teeth present, as a rule, in both jaws.
Family III. *Delphinidae*.

Family I.—PHYSETERIDAE.

This family contains the giants of the Sub-order, for to it belong the Sperm Whales or Cachalots, but it also embraces the little Pigmy Sperm Whales, which are scarcely larger than Dolphins. In the members of this family the lachrymal bones are large and distinct, and the bones of the skull are elevated behind the nostrils so as to form a well-marked prominence. The junction of the two halves of the lower jaw is in the form of a long symphysis. The throat is furrowed by two or more grooves.

Two genera of practically universal distribution are represented in South Australian waters. These genera may be distinguished as follows:—

(A.) Size large. Dorsal fin reduced to a low irregular ridge.
Genus I. *Physeter.*

(A¹.) Size small. Dorsal fin developed and sickle-shaped.
Genus II. *Kogia.*

Genus 1.—PHYSETER (Linnaeus, 1758).

This genus contains the great Cachalot or Sperm Whale, which roams all seas except those of the Arctic regions. Some forty to fifty teeth are present in the lower jaw, and these teeth are conical, curved, and devoid of an enamel covering.

Sperm Whale, Cachalot.

Physeter macrocephalus (Linnaeus, 1758).

Next to the Blue Whale, the Cachalot is the largest living mammal, and although lengths of over 80 feet have been given for this species, it would seem that between 55 and 60 feet was about the average for full grown specimens.

Figure 194.—Outline of *Physeter macrocephalus*. About $\frac{1}{250}$ natural size.

The Sperm Whale was hunted by South Australian whalers after the passing of the Right Whale from South Australian waters. From a commercial point of view spermaceti and ambergris, as well as oil, are the products of the Cachalot, and the rewards of the hazardous enterprises undertaken for its capture by the old-fashioned whalers. The animal is an easy one to recognise, even when seen far out at sea, and no more than the spouting is visible, for only a single column of breath, condensed as a jet, is produced, and this is directed forwards. The head is relatively

enormous, for it is massive in build, and measures one-third of the length of the body. (*See* Figure 194.) The dorsal surface is dark, almost black, and on the sides the colour shades to grey, which changes to white on the belly.

In November, 1881, a Cachalot was stranded at Point Bolinbroke, Port Lincoln, and the skeleton of this specimen, which is 53 feet long, is preserved in the State Museum.

Genus 2.—KOGIA (Gray, 1866).

This barbarously-named genus of the Pigmy Sperm Whales corresponds on broad lines to the genus *Neobalaena*, or Pigmy Right Whales, among the *Mystacoceti*.

It comprises a rather uncertain number of species of small whales—under fifteen feet in length—which possess a sickle-shaped dorsal fin and eighteen to thirty teeth. In outward appearance these little whales are rather like dolphins, this likeness being heightened by the small size of the head, the backwardly situated blow-hole, and the well-developed sickle-shaped dorsal fin.

Pigmy, or Short-headed, Sperm Whale.

Kogia breviceps (Blainville, 1838).

This little whale is only about ten feet long; it has thirteen pairs of ribs and twenty-six to thirty teeth in the two sides of its lower jaw. (*See* Figure 195.) In colour it is black on the dorsal and yellowish-white on the ventral surface. Its range is wide, extending at least from the Cape of Good Hope to Timor.

Figure 195.—Outline of *Kogia breviceps*. About $\frac{1}{40}$ natural size (after Oliver).

In South Australia it is represented by a lower jaw obtained some forty years ago at Encounter Bay. In this lower jaw the teeth number thirteen on each side.

Family II.—ZIPHIIDAE.

The family of the Beaked Whales is one of peculiar interest, not only on account of the structural peculiarities of its members and their affinities with extinct forms, but also by reason of the rariety of the species and the paucity of our knowledge concerning them. The family is a very distinct one, and its members are distinguished by the reduced condition of the dentition, the presence of a discrete lachrymal bone, and the development of the sickle-shaped dorsal fin.

Only one genus is represented in the waters of South Australia.

Genus MESOPLODON (Gervais, 1850).

The whales of the genus *Mesoplodon* are relatively small animals, under twenty feet in length, with a single pair of functional teeth in the lower jaw, embedded in the mandible at or near the middle. There are nine or ten pairs of ribs, of which the first eight are bifid at their vertebral ends. Of this genus there are two species recorded from South Australian waters. These two species are differentiated as follows:—

(A.) Mandibular tooth large, with the apex directed outwards.
M. layardi.

(A^1.) Mandibular tooth small, with the apex vertical.
M. grayi.

(1). Long-toothed Beaked Whale. Strap-toothed Whale.

Mesoplodon layardi (Gray, 1865).

This rare Beaked Whale is distinguished by its mandibular tooth, which is seated upon a flat strap-like base and is directed outwards and backwards. The front portion of the body is grey in colour and the hind portion black, the tip of the tail flukes being yellowish. (*See* Figure 196.) The large tooth projecting from the lower jaw and the striking colouration render the species a very distinct and remarkable one.

Figure 196.—Outline of *Mesoplodon layardi*. About $\frac{1}{60}$ natural size (after Waite).

In February, 1919, a specimen of this whale was stranded near Kingston, in Lacépède Bay. The whale measured fifteen feet three inches and was a young male. Its skeleton is preserved in the State Museum, and remains as the only record of this species in South Australian waters.

(2) Small-toothed Beaked Whale.

Mesoplodon grayi (Haast, 1876).

This small and rare Beaked Whale was at one time placed in a separate genus—*Oulodon* (Haast)—on account of the fact that it has rudimentary teeth embedded in the soft tissues of the upper jaw. This condition is, however, common to all the Beaked Whales, for small, functionless and rudimentary teeth, unconnected with the bone, appear to be present in the gum of the upper jaw of all species. The single mandibular tooth is small, vertical, and is situated opposite the posterior edge of the symphysis of the lower jaw. This species attains a length of about eighteen feet as a

maximum, and it is dark, almost black, above and rust-coloured below. Of this species, as a member of the South Australian fauna, there is the record of a right lower jaw which was found at Kingscote, Kangaroo Island, in April, 1910, and which is preserved in the collection of the State Museum.

Family III.—**DELPHINIDAE.**

This family contains the comparatively small animals known as Dolphins and Porpoises. Only one member—the Killer Whale (*Orcinus*)—attains a length of over twenty feet. The hall-mark of the family is the normal presence of functional teeth in both upper and lower jaw. The lachrymal bone does not exist as a separate element in the skull, its rudiments having become fused with the malar bone.

Six genera are represented in South Australian waters. These genera may be distinguished as follows:—

(A.) Size large, upwards of 12 feet.

(B.) Teeth in both jaws.

(C.) Teeth very large. $\frac{10-10}{10-10}$ to $\frac{13-13}{13-13}$. Head conical.
Genus 1. *Orcinus.*

(C^1.) Teeth smaller. $\frac{9-9}{9-9}$ to $\frac{10-10}{10-10}$. Head rounded.
Genus 2. *Globiocephala.*

(B^1.) Teeth in lower jaw only. $\frac{0-0}{3-3}$ to $\frac{0-0}{7-7}$.
Genus 3. *Grampus.*

(A^1.) Size smaller, under 12 feet.

(D.) Teeth small. $\frac{40-40}{40-40}$ to $\frac{65-65}{65-65}$. Maxillary portion of palate deeply grooved.
Genus 4. *Delphinus.*

(D^1.) Teeth large. $\frac{20-20}{20-20}$ to $\frac{27-27}{27-27}$. Maxillary portion of palate not grooved.

(E.) Teeth rugose. Genus 5. *Steno.*

(E^1.) Teeth smooth. Genus 6. *Tursiops.*

Genus 1.—ORCINUS (Fitzinger, 1860).

The genus *Orcinus* contains only one species, the well-known Killer Whale, whose range is world wide. It is characterised by the large size of the teeth, the conical head, the large falcate dorsal fin, and the strongly contrasted black and white colouration.

Killer Whale.

Orcinus orca (Linnaeus, 1758).

The Killer is a large animal, the males measuring twenty feet, and it is well known the world over on account of its ferocity.

In form it is extremely graceful, with a general rather shark-like

appearance, which is heightened by the long sickle-shaped dorsal fin. (*See* Figure 197.)

In colour it is strongly contrasted black and white. Generally the dorsal surface is black and the ventral surface is white, but variable white markings are common around the eye and behind the dorsal fin. Killers have been reported from the seas around Australia, New Zealand, and

FIGURE 197.—Outline of *Orcinus orca*. About $\frac{1}{60}$ natural size.

Tasmania; but, so far as can be ascertained, no specimen has come ashore on our coasts. In the State Museum is a skull, which probably came from the shores of this State, but no precise locality is recorded for it.

GENUS 2.—GLOBIOCEPHALA (Lesson, 1828).

The genus, which contains some half-dozen species, is characterised by the rounded head, long, low, dorsal fin, and general black colouration. One species occurs in South Australian waters.

Pilot Whale, Blackfish.

GLOBIOCEPHALA MELAENA (Traill, 1809).

The Blackfish is found in all tropical and temperate seas. In length it attains some twenty feet or slightly more. The head is curiously rounded; the dorsal fin is very long, low, and thick, and the whole form is stout and thickset. (*See* Figure 198.) The pectoral flipper is narrow and somewhat pointed, and the tail flukes are large and broad. The general

FIGURE 198.—Outline of *Globiocephala melaena*. About $\frac{1}{80}$ natural size.

colour is black, but the throat is commonly marked with somewhat irregular paler areas between the angle of the mouth and the flipper.

A fine skeleton of this animal, prepared from a specimen stranded in St. Vincent's Gulf, is in the State Museum.

Genus 3.—GRAMPUS (Gray, 1828).

The Dolphins of this genus, if, indeed, there is more than one species, are larger than members of the genus *Delphinus* or *Steno*. The genus is a very distinct one; and peculiar in that there are no teeth in the upper jaw and only from three to seven in each side of the lower jaw. The skeleton of a Grampus has been recorded from the shores of South Australia.

Grampus, Risso's Dolphin.

Grampus griseus (Cuvier, 1812).

In 1889 the late Mr. A. H. C. Zietz wrote:—"A skeleton of a grampus eleven feet long was found on the beach between Glenelg and Brighton, the skull of which is in the Museum." The Grampus, though having a very wide range from the North Sea to New Zealand, is a rare animal.

Figure 199.—Outline of *Grampus griseus*. About $\frac{1}{44}$ natural size (after Flower).

In length it commonly exceeds twelve feet. The head is rounded and devoid of a beak; the dorsal fin is high and sickle-shaped, the pectoral flipper is long and narrow, and the tail flukes are slender. (*See* Figure 199.) The dorsal surface is dark grey or black, the head and the anterior part of the body being lighter and somewhat mottled and irregularly streaked. The ventral surface is dirty white.

Genus 4.—DELPHINUS (Linnaeus, 1758).

The members of the genus are the True Dolphins. They are of world-wide distribution, have been known since the earliest times, and have become curiously woven into legend and history. They are long-beaked forms, and are distinguished from all other members of their family by the presence of the deep longitudinal grooves on the palate, which separate a median palatal ridge from the raised tooth-bearing margin. The Common Dolphin, which ranges all seas, is abundant on our coasts.

Common Dolphin.

Delphinus delphis (Linnaeus, 1758).

This graceful and rapidly moving animal is familiar to everyone who takes sea trips around the coasts of South Australia. Although these animals are very commonly spoken of as Porpoises, the name is bestowed

incorrectly. The True Porpoise (*Phocaena communis*) is a northern form which does not roam south of the Equator; it is smaller in size, and, like all porpoises, lacks the pronounced beak which distinguishes the Dolphin of our coasts. In colour the Dolphin is variable; usually the dorsal surface is black and the ventral surface white, but often the sides are marked by a yellowish or greenish tinge; and at times a series of greyish-green streaks is apparent along the sides. The animal is slender and built upon beautiful lines; the usual length is from 6 to 8 feet, but specimens 10 feet long have been recorded. (*See* Figure 200.)

FIGURE 200.—Outline of *Delphinus delphis*. About $\frac{1}{30}$ natural size (after Flower).

The habit which Dolphins have of swimming alongside ships and playing round the cutwater as they are travelling full speed, seems to be an outcome of the same instinct which impels dogs to rush at motor cars. It would be well worth while if those who frequently travel by sea would carefully note the exact characters of the Dolphins which may be seen on any journey around our coasts. In this connection it may be said that there is nothing to recommend the stupid practice of shooting at Dolphins from the deck of a ship which is indulged in by some thoughtless travellers.

GENUS 5.—STENO (Gray, 1846).

The Dolphins of the genus *Steno* differ from the True Dolphins by possessing fewer and larger teeth, the crowns of which are rugose; and by having no grooves upon the palate. One species has been reported from South Australian seas.

Beaked Dolphin.

STENO ROSTRATUS (Desmarest, 1817).

This species is distinguished from the Common Dolphin by its rather sturdier body and less graceful build. The dorsal surface is dull black and the ventral surface is white, the sides being yellowish. Its length is usually about 8 or 9 feet. It has a wide range from the Atlantic to the Indian Ocean, but has not been recorded from Tasmania, New Zealand, nor elsewhere in Australia. Its inclusion in the South Australian fauna rests upon the authority of the late Mr. A. Zietz; but, since no specimens are present in the State collections, it is possible that it was recorded in error, being confused with the next species.

Genus 6.—TURSIOPS (Gervais, 1855).

The genus is distinguished by possessing a short beak, a sickle-shaped dorsal fin, and pectoral flippers. The teeth are large and they differ from those of *Steno* in being smooth. Five species of Cowfish are included in the genus, but so far only one has been recorded from Australian seas.

Cowfish.

Tursiops truncatus (Montague, 1815).

The Cowfish is a stoutly built Dolphin with a rather bulky body and a head characterised by a short beak and a sloping forehead. (*See* Figure 201.)

In colour the animal is clear light grey on the dorsal surface and white on the ventral surface. In some specimens the hinder part of the body is grey both above and below. The length attained by the Cowfish is about ten or eleven feet. Although this species has not previously been reported as a member of the South Australian fauna, it is evidently not

Figure 201.—Outline of *Tursiops truncatus*. About $\frac{1}{45}$ natural size (after Flower).

uncommon around our coasts. Skulls are preserved in the State Museum, and I possess one that was found by Professor Watson on the shore at Port Lincoln in 1909, and another from Port Noarlunga which was found with soft tissues still adhering to it in 1921. A third example was found at Cowell, on the West Coast, and presented to the State Museum in May, 1925.

Order RODENTIA.

Terrestrial (occasionally semi-aquatic) mammals with teeth adapted for gnawing and eating vegetation; and with unguiculate feet. The dentition consisting of chisel-shaped incisors which have no roots and are perpetually growing; from two to six cheek teeth, devoid of cutting tubercles, and no canines. All are relatively small animals. The entire Order, which contains more genera and species than any other Mammalian group, is divided into two Sub-orders as follows:—

(A.) Upper incisors two in each jaw, the enamel extending all round the tooth. Sub-order I. *Duplicidentata.*

(A^1.) Upper incisors only one in each jaw, the enamel confined to the front of the tooth. Sub-order II. *Simplicidentata.*

Sub-order I.—DUPLICIDENTATA.

This Sub-order contains the hares, rabbits, and picas, and is represented in Australia only by the introduced forms. The second upper incisor, which characterises the Sub-order, is a minute tooth, placed behind the functional tooth and without a cutting edge. Cheek teeth $\frac{6}{5}$ $\frac{6}{5}$. The palate reduced to a narrow bony bridge between the pre-molars.

Both the Australian introductions belong to the same family.

Family **LEPORIDAE.**

The hares and rabbits contained in the family are distinguished by the possession of long ears, long hind limbs, and a short recurved tail. Within this family, however, the rabbit and the hare represent two distinct genera, distinguished as follows:—

(A.) Young at birth blind and practically naked. Supra-orbital process of the skull narrow.
Genus I. *Oryctolagus.*

(A^1.) Young at birth active, the eyes open and body completely furred. Supraorbital process of the skull stout and triangular. Genus II. *Lepus.*

Genus 1.—ORYCTOLAGUS (Lilljeborg, 1874).

This genus contains the rabbits native of Northern Africa and Southern and Central Europe. The animals excavate elaborate and extensive burrows in which the naked, blind, and helpless young are brought forth. In size the animals are smaller than members of the genus *Lepus.* The feet and ears are relatively short, and there is no darker patch of colour at the tip of the ear. The Australian animal was introduced from England, and belongs to the type form, which was originally described from Germany.

Rabbit.

Oryctolagus cuniculus (Linnaeus, 1758).

There is no need to describe Australia's curse, and it is now too late to give a detailed account of its introduction, or of its spread through the State. According to tradition the first rabbits arrived in the ship *Governor Gawler* in 1840, and to its cargo of sixteen live rabbits we owe the present population. The matter is, however, more complex than this simple turning down of a few in 1840, for Victoria also had its introductions, and it is certain that the rabbit did not populate South Australia from a single focus, but has been introduced at more than one place and at different times. By now it has spread over the entire State. Upon Kangaroo Island it was liberated many years ago, but, fortunately for that Island, it has ceased to exist there; and it is quite likely that the

abundant "goanas" (*Varanus*) have had a hand in its extermination. Upon Flinders Island, in the Bight, it was also liberated, and there, too, it has not greatly thrived, but the large number of feral cats on this island probably accounts for this. From the arid Centre to the Coast the rabbit now swarms in South Australia. It exhibits all the ranges of colour from white to black, met with elsewhere and inherited in the Australian animal from its ancestors. It, however, seems to have adopted habits which, possibly always latent in the species, are only brought out under the severe conditions in which it lives in bad seasons in the North, for it has an astonishing aptitude for climbing high into Mulga bushes in order to obtain the sparse foliage which that type of vegetation produces. It will nibble the bark as far as it can reach when standing on its hind legs, and having exhausted that source of food, it starts to climb into the bushes when the season renders other vegetation unprocurable. Though it will climb well over six feet into the bushes, it shows its unfitness for this mode of life in the numerous corpses hung high in the Mulgas where rabbits have slipped and become caught in the forks of the branches. From the point of view of the zoologist who is interested in the native mammals of Australia, it has some aspects of interest. Firstly, it has led to the scarcity of many native herbivores (such as the Bettongias) in consequence of out-grazing poor country. Secondly, it has ousted some of the omnivorous marsupials, such as *Thalacomys,* by taking possession of every possible breeding burrow. Thirdly, in consequence of the broadcast method of rabbit poisoning, it has led to the passing of many interesting marsupials which will devour poisoned pollard, bran, potatoes, or whatever bait is used. But against this we have to set off the rather unlooked for fact that, in those places where the Aboriginals still depend in great measure on their own hunting, the ease with which rabbits are procured by the lubras has spared many of the native animals. A native woman can always obtain plenty of rabbits with a very much smaller expenditure of energy than is required to cut even a single opossum from a box-tree. In this way the marsupial fauna is actually increasing in some places. Again, we must not forget the zoologically interesting fact that the advent of the rabbit has placed the future of the Dingo on an altogether different footing from what it would have been if man had been allowed to cope with wild dogs having only the native animals as their source of food. The Dingo and the Wedge-tailed Eagle have a price on their heads and every man's hand is against them; but they have the rabbit as an asset.

The introduction of the rabbit into Australia has, philosophically, much of interest in it; and the great advantages which men could foresee accruing from its successful establishment make pathetically amusing reading to-day. So, too, do the accounts of the patient endeavour, of the difficulties overcome, and the success after many trials that accompanied its establishment in some places. The establishment of the rabbit as an

inhabitant of Australia has been a complete success—the rabbit is thoroughly established; but the blessings accruing from its introduction are not so much emphasized to-day.

Genus 2.—LEPUS (Linnaeus, 1758).

This genus contains the hares, which are spread over Europe, Asia, North America, and Africa. The animals excavate no burrows, and the young are brought forth with their eyes open and well able to shift for themselves. The feet and ears are long and are tipped with black. The Australian animal was presumably (but in the absence of definite knowledge by the writer) introduced from England, and therefore probably has as its parent type:—

Western European Hare.

Lepus europaeus occidentalis (de Winton, 1898).

This Hare has its ancestral home in England, the Isle of Man, and the lower, more cultivated portions of Scotland. A word may here be said about the source of introduced animals. Although the introductions into Australia are matters of recent history, it is very difficult to obtain precise information as to the exact source of the introduced animals and the exact site and date of the introduction. In Victoria a large number of hares were liberated in various parts of the country in 1870 and 1871 by the Zoological and Acclimatisation Society. These matters are all of interest, the first from a zoological and the other two from an historical point of view. We can only assume now that our introduced Hare was of this type and that the rabbit was the typical *Oryctolagus cuniculus*.

It is well known that Darwin speculated upon the changes which isolation and environment had produced in the rabbits introduced into the Island of Porto Santo. These changes he regarded as of an evolutionary nature. But Darwin was unaware that the Porto Santo rabbits were introduced from Spain, and differ in no way from their parental form, which is different from the English rabbit, which Darwin supposed to be their ancestors. With the hares, the matter is still more complex. The Irish Hare, the English Hare, and the Hare of Northern Scotland are all different types, and nearly twenty species and sub-species of hares inhabit Europe. In the absence, therefore, of any information as to the precise origin of the hares liberated in Australia, it is useless to compare the Australian animal as it now is with its possible European parent.

The Hare has little claim on the Australian zoologist, it is not a disturbing element in the fauna, nor has it arrived at the stage of being an economic curse. It is abundant all over the Southern portion of the State, extending northwards to the fringe of the saltbush country, but not into the typical saltbush and bluebush plains of the North.

Sub-order II.—SIMPLICIDENTATA.

This immense Sub-order contains the vast majority of the Rodents, and no less than twenty families are embraced within it. The Simplicident Rodents are distinguished by possessing only two upper incisors, the enamel of which is confined to the anterior surface of the teeth. The incisors are permanently growing teeth and their enamel is often coloured with some shade of yellow. The bony palate is well developed and is not reduced to a narrow bridge extending between the premolars as it is in the Duplicidentata. So far as Australia is concerned, all the members of the Sub-order, indigenous or introduced, are confined in one family, for they are, broadly speaking, all rats and mice.

Family **MURIDAE.**

Within the family are included rather more than a third of all existing Rodents. All members are small and, in general form, most of them are reminiscent of the common house rat. The skull is narrow and compressed in the frontal region, the zygoma is composed of long processes from the temporal and maxillary, the jugal being merely a narrow splint joining these two processes. The anterior root of the zygoma is flattened into a more or less vertical plate. There are never more than $\frac{3-3}{3-3}$ cheek teeth, and sometimes there are fewer. The tail is usually nearly naked and scaly, the first digit of the pes is rudimentary. The rats and mice of Australia are contained within two Sub-families of the Muridae, and the separation of these two Sub-families is effected as follows:—

(A.) Cheek teeth reduced to two on each side above and below. These molar teeth being flattened and divided into transverse lobes.

Sub-family I. *Hydromyinae.*

(A^1.) Cheek teeth three on each side above and below. These molar teeth being tuberculated; those of the upper jaw showing a disposition of tubercles into three longitudinal rows.

Sub-family II. *Murinae.*

Sub-family I.—**HYDROMYINAE.**

The Sub-family of Murids having only two molar teeth in each jaw is confined to Australasia, and contains two genera, distinguished as follows:—

(A.) Modified for aquatic life. Pes partially webbed. Rhinarium hairy. Skull considerably modified from usual murine type. Genus (1) *Hydromys.*

(A^1.) Terrestrial and not departing widely from the normal murine form. Genus (2) *Xeromys.*

Genus 1.—HYDROMYS (Geoffroy, 1895).

This peculiar genus represents the greatest specialization of the native Australian rodents. We have seen that, although the Ornithodelphia produced the specialized *Ornithorhynchus* as an aquatic type, the Didelphia failed to specialize any member of its phylum as a water-living animal in Australia. *Hydromys* is the aquatic specialization of the Australian Monodelphia and is, in every way, a very remarkable rodent

Figure 202.—The characteristics of the cheek teeth of the Genus *Hydromys*, illustrated by *H. chrysogaster*. A. crown pattern of left upper molars; B. sockets for roots of left upper molars; C. crown pattern of left lower molars; D. sockets for roots of left lower molars.

type. The members of the genus are large, the length of head and body being frequently more than a foot. The muzzle is broadened and the head flat; the eyes, as is usual in aquatic animals, being situated rather high up towards the crown of the head. The pes is more specialized for an aquatic life than the manus, being enlarged and partially webbed. The most remarkable skeletal character is the reduction in the number of the molar teeth; instead of the usual three molars in each side of each jaw, *Hydromys* has only two. (*See* Figure 202.)

The genus is an old-established Australasian one and its range extends from Key Island and New Guinea throughout the whole of Continental Australia and to Tasmania. One species—a widely distributed one—occurs in South Australia.

Australian Water Rat. Beaver Rat.

Hydromys chrysogaster (Geoffroy, 1805).

This is the fine golden water rat with white tipped tail that frequents most of the watercourses of South Australia. The general form is elongated and flattened, with short limbs, very large feet and a thick tail, which is shorter than the length of head and body. The head is very unlike that of an ordinary rat, for the muzzle, instead of being pointed and flattened from side to side, is broadened out by being flattened from above. (*See* Figure 203.) The nose is wide, the nostrils crescentic and situated laterally and dorsally, and the two pads on either side of the nose are prominent. The head is flat, the ears very small and in life are carried close to the head. The eyes are relatively small and situated near

to the top of the head. The pads of the nose give rise to abundant mysticial vibrissae, of which the front members are light and the hind ones dark, the longest measuring 60 mm. The coat is sleek and shining and consists of rather coarse, shining hairs and a very dense, soft underfur of a smoky-grey colour. The hairs of the back average 15-20 mm. in length, the longer ones being situated at the hinder end of the body. The general colour of the dorsal surface is a variable brilliant golden brown. Each hair is grey at the root; dark, almost black, at the tip and golden yellow in the intermediate portion. The variability in coat colour mainly depends on the length and intensity of the black tips to the hairs, some specimens being almost black on the dorsal surface. At the sides of the body the dark tips of the hairs are less marked and the golden colour predominates. The ventral surface varies from yellowish-white to

FIGURE 203.—*Hydromys chrysogaster*. Characters and the head of a male specimen from Mount Lofty. Three-quarters natural size.

deep orange, the colour in some animals being extremely brilliant. The ears are small and rounded, and, in life, are closely adpressed to the sides of the head. Manus and pes clothed above with fine short yellowish-white, golden or dusky hairs; palms and soles, naked and dusky. The manus is not greatly altered; its digital formula remaining $3>4>2>5>1$, which is typical of most normal rats (*See* Figure 204); but the pes is profoundly modified into a swimming paddle. The pedal digital formula is altered from $3>4>2>5>1>$ to $4>3>2>5>1$ and the pads are flattened and ill defined; there is a partial webbing, especially developed between digits 2, 3, and 4. (*See* Figure 205.) The tail is thick at the base and uniformly tapering. The body tapers very gradually to the tail, the hind end of the animal being prolonged into the base of the tail.

The proximal portion of the tail is clothed for some 30 mm. with a continuation of the general body hair, this gives way to coarse, shining, closely adpressed, black hairs, and, towards the tip, changes suddenly to shining, closely adpressed, white hairs.

The length of the white portion is extremely variable (*see* table of measurements) and in very dark animals it may be altogether wanting.

It is rather remarkable that a very large number of water rats have a curious pathological condition of the tail and not infrequently the end is missing.

The nipples are four in number and abdomino-inguinal in situation.

FIGURE 204.—*Hydromys chrysogaster.* Palmar surface of left manus. Twice natural size.

FIGURE 205.—*Hydromys chrysogaster.* Plantar surface of left pes, showing the aquatic modifications. Twice natural size.

DIMENSIONS.

	♂	♂	♀	♀	♂	♀	♂
Head and body	390	360	355	345	330	330	200
Rhinarium to eye	40	30	30	30	30	28	22
Rhinarium to ear.....	57	55	56	55	57	52	43
Ear	16	16	15	15	16	15	13
Manus	24	24	23	22	23	23	18
Pes.....	66	62	58	58	62	55	48
Tail	200	225	255	220	230	245	162
White tip of tail.....	Imperfect	45	72	Nil.	10	38	90

The skull is of remarkable shape, being flattened along the top with a narrow, fusiform, facial region and a flattened, rounded, brain case. (*See* Figures 206 and 207.)

DIMENSIONS OF SKULL.

	♂	♂	♂	♀	♀
Greatest length	60	57	56	52	51
Basal length	56	53	53	50	49
Bizygomatic breadth	29	28	28	25	25
Intercrbital breadth	7	6	7	7	6
Nasals, length	20	18	19	17	17
Nasals, breadth	5	6	5	5	5
Palate, length	30	29	29	26	27
Upper molar series	9	9	9	9	9

All measurements are made on animals obtained in the Torrens in Adelaide.

The incisors are strong, the upper pair orange in colour, the lower pair finely pointed and light yellow. It is needless to say that the so-called "scissorslike" action (described by Sir Bertram Windle in

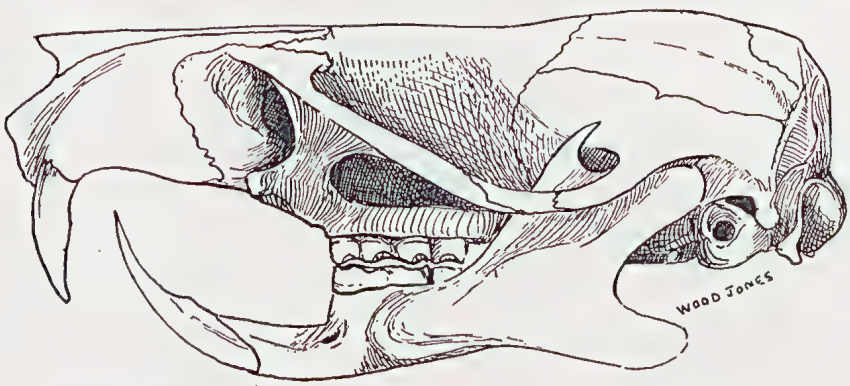

FIGURE 206.—*Hydromys chrysogaster*. Lateral aspect of skull. One-and-a-half times natural size.

1887), by which these lower incisors are supposed to move apart and close together again, has no foundation in fact and is only an extension of the similar absurd statement (made by Murie and Bartlett in 1866) concerning the "scissors" action of the lower incisors of the Kangaroos. The two molar teeth are remarkable structures. The anterior tooth is far larger than the posterior one; it has three transverse laminae and some seven roots in the upper jaw and two laminae and eight or nine roots in the lower jaw.

The Beaver rat is widely distributed in South Australia. It still lives along the banks of the Murray, whence the specimens were obtained by Gould upon which he founded the species *Hydromys fulvolavatus*, which, being merely a colour variation not confined to the Murray, should be known as *Hydromys chrysogaster fulvolavatus* (Gould, 1863).

To the Murray River natives in South Australia it is known by the name Rakali. It also inhabits the Onkaparinga and even the Torrens in Adelaide. It is nocturnal, shy, and unobtrusive, and it doubtless still lingers in many places where its presence is unsuspected. Its diet largely consists of the little crayfish known as yabbies, and shell fish; but the

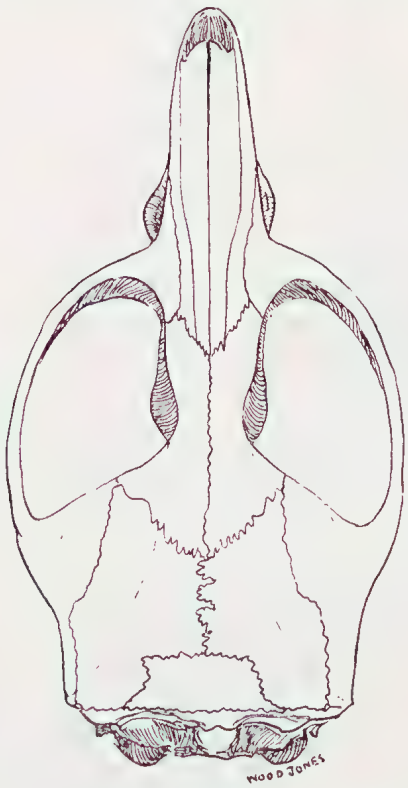

FIGURE 207.—*Hydromys chrysogaster.* Dorsal aspect of skull. One-and-a-half times natural size.

animal is disliked by fishermen on the Murray as it also eats the fish in their nets. It is easily trapped by the use of meat or fish as bait, but it also probably eats aquatic plants, since some of the little streams it frequents offer apparently too small a field for a truly carnivorous animal.

I know no observations on the animal in captivity, and very few persons ever see it in a state of nature.

GENUS 2.—XEROMYS (Thomas, 1889).

This, the second genus of the Australasian Murids possessing only two molar teeth in each side of each jaw, is far more normally murine in its general appearance than is the Water Rat. The genus contains only a single species, *X. myoides* (Thomas, 1889), which occurs in Queensland, but does not extend its range to this State.

SUB-FAMILY II.—**MURINAE.**

This large Sub-family includes the true rats and mice. All members of the group are very similar in general characteristics, being light, active little animals, with rather large ears, large bright eyes, and long and scaly

tails. Their colouration is generally sombre, consisting in some shade of brown or grey, and they are adapted to an active, crepuscular, mainly terrestrial, life.

The tuberculated molars show a general disposition of the tubercles into three rows running the length of the three molars; but in the actual number and disposition of the tubercles considerable variation is shown in the different genera. It is upon the arrangement of the tubercles that many of the genera are founded, and, therefore, the study of the patterns of the molar teeth is a matter of some importance. It is often a very difficult matter to determine the exact dispositions of these tubercles, since the crown pattern of molars varies so greatly with the degree of wear of the teeth. In consequence of this state of affairs several mistakes have been made in assigning Australian rats to their proper genera—the ordinary ship rat, for instance, having been given several generic titles in Australian zoology. Since the interpretation of the molar crown pattern of old individuals is often very difficult, owing to the wearing of the cusps, it was suggested by the writer that the sockets for the roots of the teeth might in many cases be relied on. The number and disposition of the roots vary markedly in the different genera, and in order to avoid purely technical description and abundant repetition, a simple diagram of crown pattern and root sockets will be given for the genera described. In the tables and descriptions this condition of the root sockets is expressed in the form of a formula which may be termed the root formula. The expression $\frac{5-4-3}{4-3-3}$ indicates that the first, second, and third upper molars have 5, 4, and 3 roots and sockets respectively, whilst the first, second, and third lower molars possess 4, 3, and 3 respectively. It must be said at once that the study of the Australian Murines is a matter of considerable difficulty, since most of the type specimens are preserved in Museums of other lands, and an insufficient amount of first hand work has been carried on in Australia. The results of such first hand work as has been done have, for the most part, remained confined to the pages of the publications of the various learned societies, and have failed to become incorporated in the more or less popular books dealing with Australian zoology. For this reason we have a mass of almost legendary and frequently recopied accounts of our Rodents, much of which can be of little real value until the material is worked over again with more rigid and more modern methods. Those forms with which the writer has no first hand acquaintance must perforce be dealt with from previously published accounts, and since the value of these accounts varies much with their authorship, the source of such borrowed information is indicated.

It is a matter of considerable difficulty to furnish a key to the different genera represented in the fauna of South Australia, since the characters used for the diagnosis of the several genera are very varied. The key provided will probably assist the student in determining into which group a South Australian rat should be placed.

KEY TO THE GENERA REPRESENTED IN SOUTH AUSTRALIA.

(A.) With normal hind limbs and feet with 6 pads.

(B.) Short-eared, normal, rats and mice.

(C.) Molar teeth normal and not broadened.

(D.) Incisors not notched. Root formula $\frac{5-4-3}{4-3-3}$.

(E.) Skull stoutly built, with supraorbital ridges.
Genus 1. *Rattus.*

(E¹.) Skull lightly built, without supraorbital ridges.
Genus 2. *Pseudomys.*

(D¹.) Incisors notched. Root formula $\frac{3-3-2}{2-2-2}$.
Genus 3. *Mus.*

(C¹.) Molar teeth greatly broadened. Genus 4. *Mastacomys.*

(B¹.) Long-eared, specialized, rats.

(F.) Tail thickened at the base. Genus 5. *Laomys.*

(F¹.) Tail normal and not thickened at the base.

(G.) Without additional postero-internal cusps on the molars.
Genus 6. *Leporillus.*

(G¹.) With additional postero-internal cusps on the molars.

(H.) Skull modified, broadened and flattened.
Genus 7. *Conilurus.*

(H¹.) Skull normal in shape. Genus 8. *Zyzomys.*

(A.) With elongated hind limbs and feet with reduced pads.

(I.) Without a gular pouch. Genus 9. *Notomys.*

(I¹.) With a gular pouch. Genus 10. *Ascopharynx.*

Genus 1.—RATTUS (Fitzinger, 1867).

The genus contains what may be termed the normal rats: it is the largest assemblage of the *Murinae* and its members have the widest geographical range. So far as is known, all members of the genus possess at least one pair of thoracic nipples. The molar teeth are slightly graduated in size; but there is no tendency for the first molar to be dominant or the third to be rudimentary. The skull is strongly built, with, as a rule, well marked supraorbital ridges, which generally extend back to the outer margins of the interparietal. The front edge of the zygomatic root is convex. (*See* Figure 208.) More than twenty indigenous

species represent the genus in Australasia, and of these some seven are probably inhabitants of South Australia. For characters of the dentition *see* Figure 209.

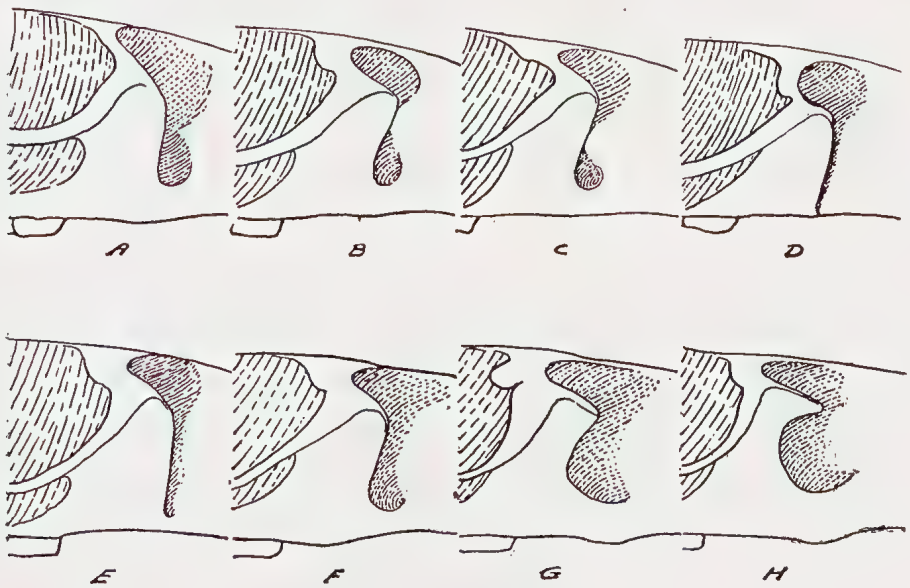

FIGURE 208.—The anterior root of the zygoma of the right side in a series of murine skulls. A=*Rattus* (*greyi*); B=*Thetomys* (*nanus*); C=*Leggadina* (*hermannsburgensis*); D=*Mus* (*musculus*); E=*Leporillus* (*apicalis*); F=*Laomys* (*pedunculatus*); G=*Notomys* (*longicaudatus*); H=*Ascopharynx* (*cervinus*).

The descriptions of many of the species are at present so unsatisfactory that it is impossible to draw up a key for the differentiation of even the species recorded from this State.

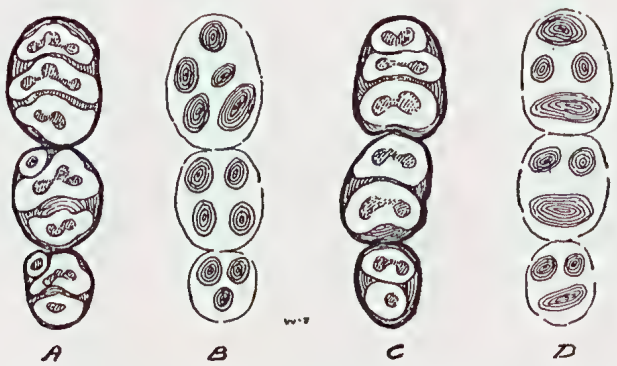

FIGURE 209.—The characters of the cheek teeth of the Genus *Rattus*, illustrated by *R. greyi*. A. crown pattern of left upper molars; B. sockets for roots of left upper molars; C. crown pattern of left lower molars; D. sockets for roots of left lower molars.

(1) Allied Rat.

RATTUS ASSIMILIS (Gould, 1857).

In the absence of any specimens from which a full description may be written, the following account is taken from the work of Gould. The fur is soft and silky. General colour of face and all the upper surface and

sides light brown very finely pencilled with black. Under surface greyish buff. The base of the hairs all over the body is dark slaty grey. The facial vibrissae are black. Tail not so long as the head and body; nearly destitute of hairs. Manus and pes clothed with fine silky hairs, which give them a delicate appearance. The incisor teeth are very long and narrow.

DIMENSIONS.

Head and body	181
Tail	150
Pes	31

Judging by Gould's figure, the species has very much the general appearance of *R. greyi*, a species which he did not recognise, but according to Gould's measurements the tail is considerably longer than it is in that animal.

The distribution is said to be a wide one, ranging from North-Eastern Queensland to South-Western Australia.

I know of no recent records of the rat as an inhabitant of this State.

(2) Central Australian Rat.

RATTUS CULMORUM (Thomas and Dollman, 1908).

This is a spiny haired rat with a wide distribution through the more arid inland parts of the Continent. In the absence of material from which an account can be written, the original description of Thomas and Dollman is relied on.

The coat is sparse and coarse and more or less admixed with flattened spines. General colour above brownish fulvous, varying considerably according to the degree of spinousness. Sides more buffy. Under surface whitish, often with a tinge of yellow; hairs pale, slaty basally on the belly, whitish throughout on the throat and sometimes on the inguinal region. Ears rather short, practically naked. Upper surface of manus and pes white. Tail of medium length, the scale rows averaging ten to the centimetre towards the base of the tail. The tail is sparsely covered with hair, dull brownish above, lighter below. Nipples, four thoracic and six abdomino-inguinal.

Skull short and broad; bullae large.

The form which inhabits, or inhabited, South Australia differed from the type described above in the following particulars. The fur is considerably longer; the hairs of the back commonly 20 mm. in length, while the longer piles overtop them by some 10 mm.

General colour rather greyer and less definitely fawn-coloured. The ventral surface is grey instead of white. In the skull the tooth row is shorter and the bullae smaller than in the typical *R. culmorum*.

This South Australian sub-species is known as *R. culmorum austrianus* (Thomas, 1921).

DIMENSIONS.

Head and body	155
Tail	120
Pes	28

DIMENSIONS OF SKULL.

Greatest length	34
Zygomatic breadth	18
Nasals, length	13
Interorbital constriction	4·5
Bullae	7·4
Upper molar series	6·8

Mr. Oldfield Thomas notes that this was "evidently a common rat in South Australia in the forties, but whether it still exists in any out-of-the-way part of the colony we have no evidence to show." I know of no recent records or specimens of the species. So far, the out-of-the-way place has not been found by collectors, and this fact should prove a stimulus to our field naturalists.

(3) Dusky-footed Rat, Water Rat.

RATTUS LUTREOLA (Gray, 1841).

The Dusky-footed Rat has a very wide range in Australia and Tasmania. The first examples to be described were taken in the King George's Sound district of Western Australia, and these were appropriately named by Waterhouse as *R. fuscipes* in 1840.

Since this Western form differs in some details from the form that inhabits Tasmania and Eastern Australia it is best to reserve the name *R. fuscipes* for the Western Dusky-footed Rat and to employ Gray's name, *R. lutreola,* for the Eastern Dusky-footed Rat.

Since the rat fauna of our State is so little known, it has been thought best to give descriptions of both forms, for it is possible that South Australia, in this case, as in so many others, may prove to be the meeting place of Eastern and Western types.

The original description of the Western Dusky-footed Rat, as given by Waterhouse, is as follows:—Form stout; ears moderate; tail equal to the body in length. Fur very long. General tint of upper surface and sides of head and body, blackish brown, with an admixture of grey. Under-parts greyish white. Feet brown. Hairs greyish at the tip. Tail black, sparingly clothed with bristly hairs. Ears rather sparingly clothed with hairs which are, for the most part, of a brownish-grey colour. Hairs of the back about 18.5 mm. in length, deep grey in colour, annulated with brownish yellow near the tip, the tip itself blackish. The long hairs about 30.5 mm. in length and black throughout. Upper incisors orange, lower incisors black.

DIMENSIONS.

Head and body	172·5
Rhinarium to ear	37·5
Ear	13
Pes with claw	27·5
Tail	106·5

An extended account of the Eastern Dusky-footed Rat has been given by Waite (1900) from specimens obtained in the Blue Mountains of New South Wales. These rats were described as follows:—Fur long, very thick and soft to the touch. Colour rather variable, from yellowish-brown to blackish-brown. Basal portion of the fur deep grey, almost black, the tips yellow, sometimes inclining to reddish, thickly interspersed with long black hairs. Muzzle and face grey, facial vibrissae dark brown or black. On the sides of the body the black hairs are less numerous and shorter, and the yellow colour lighter. On the lower surface the basal fur is grey, not so dark as on the back, and more broadly tipped with yellow, which, however, is very pale. Ears small, almost naked without, and sparingly clothed with short yellowish-brown hairs within; laid forward they fail to reach the eye by their own length. Limbs thickly clothed with greyish-brown hairs. Tail shorter than the head and body; the hairs are longer than two rows of scales, but do not conceal them; the hairs are not particularly stiff and are of a black colour; twelve scales to the centimetre. Nipples, four thoracic and six abdomino-inguinal.

DIMENSIONS.

	♂	♀
Head and body	173	176
Rhinarium to ear	36·6	34
Ear	21	20
Pes	31·2	29·3
Tail	116	119

DIMENSIONS OF SKULL.

	♂	♀
Greatest length	40·3	39·6
Basal length	36·6	36·2
Zygomatic breadth	21·9	21·7
Interorbital constriction	5·3	5·6
Nasals, length	15	14·4
Palate, length	21·9	21·7
Upper molar series	8·1	8·3

The South Australian form is a fluffy, sturdy, sombre-coloured rat. The prevailing colour results from the fine flecking of the black hairs with yellow points, the whole effect being a fine grizzle of black and yellow which is very like the colouration of a dark Short-nosed Bandicoot (*Isoodon obesulus*). The dorsal surface and sides of head and body, the

DIMENSIONS.

	♂	♂	♀	♀
Head and body	186	168	153	152
Rhinarium to eye	20	17	17	18
Rhinarium to ear	43	35	34	38
Ear	17	16	16	15
Manus	11	10	10	11
Pes	26	29	26	28
Tail	131	124	127	131

The skull is lightly built and has but slight supraorbital ridges.

DIMENSIONS OF SKULL.

	♀
Greatest length	36
Basal length	29
Bizygomatic breadth	18
Interorbital breadth	5
Nasals, length	13
Nasals, breadth	4
Palate, length	16·5
Upper molar series	6

This little rat is widely distributed in South Australia, but is nowhere very abundant. It does not make its presence conspicuous and has no liking for the habitations of man. It excavates no conspicuous burrows, leaves no marked runs or signs of its presence, and lives obscurely. For this reason its presence is often unsuspected, and traps set purely at a venture will often procure a specimen in places where one was quite unlooked for. It is fond of damp places, where the undergrowth is luxuriant, but it also lives on the seashore, and in sandhill country. Grey's rat is probably the only native rat now living on Kangaroo Island. On this island it is rare, probably in consequence of the abundance of the large Goana (*Varanus*); but specimens have been obtained at Rocky River and at D'Estree Bay.

For the most part it makes its home under fallen timber or beneath boulders, and I have never seen a genuine burrow constructed by these rats on the mainland, though on Kangaroo Island most of the rats live in deeply excavated holes. They are easily taken with any bait, but they are, as a whole, rather strictly vegetarian in their diet. They are extremely gentle, easily handled even when freshly caught, and show little inclination to bite.

It would appear that they do not live in communities, and the population of even a favoured site is in reality very small. At present their head-quarters seem to be in that very characteristic part of the State between the Southern shores at Encounter Bay and Mount Moon; but I have trapped it as far afield as Coffin's Bay. In the region about Mount Moon the rat frequents the many streams which intersect the low-lying country,

(4) Tawny Rat.

RATTUS VELLEROSUS (Gray, 1847).

Of this rat, which was said by its describer to be like the last species but with longer and paler fur, I know of no recent records or specimens. The type described came from "between the Murray and the Glenelg rivers." The rat is a long-haired one with a dense, soft, coat. The general colour brownish, lightened by the presence of white-tipped hairs. The hairs smoky at the base, changing to brown, becoming paler towards the tips, which are white. Tail shorter than the head and body, the sparse short, stiff, hairs not hiding the scales. Ears medium in size and rounded.

DIMENSIONS.

Head and body	190
Tail	112

Gould suggested that the animal might be an abnormal form of the last species; but in the absence of any further specimens from the original locality it is impossible to be certain of its actual status.

(5) Sir George Grey's Rat.

RATTUS GREYI (Gray, 1841).

This is a widely distributed little rat, and appears to be the central member of a group of small native rats characterized by their light build, fluffy pelage, and small white manus and pes. (*See* Figure 210.) Gray's original description of the species, which he named in compliment to Sir George Grey, is meagre:—"Fur brown, with close long slender pale-tipped black hairs; sides yellowish brown; throat and beneath yellowish; feet whitish, ears nearly naked, with close-pressed short greyish hairs; tail with close-pressed short greyish hairs." Fortunately the original rats thus described are in the collection of the British Museum, and in 1920 the writer sent typical South Australian specimens for comparison with the originals. There is, therefore, no doubt that the rat found by Sir George Grey and described in the "Journals of two expeditions of Discovery in North-West and Western Australia" still exists. In the interval between 1841 and 1920, however, the rat has been rather under a cloud since, by some error, J. D. Ogilby, in the Catalogue of Australian Mammals in the Australian Museum, 1892, applied the description of an altogether different rat to this species. This error has unfortunately been copied from book to book, with the result that to-day the descriptions available in Australian literature have no relation whatever to the animal described.

In current Australian literature generally available to students, Grey's rat is said to be coloured an "intense reddish-brown," with "reddish-brown" feet; whereas, in Gray's original description, and in fact, its feet

are white or nearly so and there is no intense red anywhere on its colouration. The pelage is fine and soft, the hairs becoming increasingly long towards the hinder end of the body in a very characteristic fashion. Over the shoulders the average length of the hairs is some 12 mm., whilst at the hind end of the body many of the long hairs are 30 mm. in length. This condition produces a very characteristic appearance in the living animal, for the hind end seems unduly broadened and can best be described as bunchy. A live house rat appears to taper away towards its loins and tail, but the little rats of the *greyi* group when living look squat and bunched about the hind quarters.

The general colour of the dorsal surface is a subdued brown. The individual hairs are tipped with a rather warm brown, but the smoky colour of the dense underfur shows through this warmer surface colour and subdues the whole.

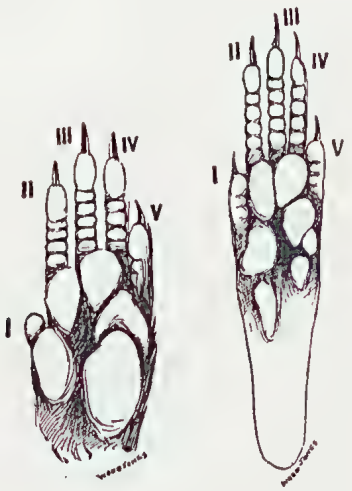

FIGURE 210.—*Rattus greyi.* Left manus and pes. Manus three times, pes one-and-a-half times natural size.

The sides and ventral surface are greyish-white, often with a distinct tinge of yellow. The individual hairs of the ventral, as well as the dorsal, surface are smoky at their bases. The manus and pes are white and delicate. The soles of the pes are either white or very slightly dusky. Mysticial vibrissae dark, the longest measuring some 50 mm. The ulnar carpal vibrissae pure white. Ears rather small: almost naked within, clothed with short brown hairs without.

Tail shorter than the head and body. Sparsely clothed with short stiff hairs; dark above, paler beneath. Scales not obscured by sparse hairs, averaging 13 to the centimetre. The number of nipples is variable, usually pectoral 4, abdomino-inguinal 6; but in some specimens only 2 pectoral nipples are present.

DIMENSIONS.

	♂	♂	♀	♀
Head and body	186	168	153	152
Rhinarium to eye	20	17	17	18
Rhinarium to ear	43	35	34	38
Ear	17	16	16	15
Manus	11	10	10	11
Pes	26	29	26	28
Tail	131	124	127	131

The skull is lightly built and has but slight supraorbital ridges.

DIMENSIONS OF SKULL.

	♀
Greatest length	36
Basal length	29
Bizygomatic breadth	18
Interorbital breadth	5
Nasals, length	13
Nasals, breadth	4
Palate, length	16·5
Upper molar series	6

This little rat is widely distributed in South Australia, but is nowhere very abundant. It does not make its presence conspicuous and has no liking for the habitations of man. It excavates no conspicuous burrows, leaves no marked runs or signs of its presence, and lives obscurely. For this reason its presence is often unsuspected, and traps set purely at at venture will often procure a specimen in places where one was quite unlooked for. It is fond of damp places, where the undergrowth is luxuriant, but it also lives on the seashore, and in sandhill country. Grey's rat is probably the only native rat now living on Kangaroo Island. On this island it is rare, probably in consequence of the abundance of the large Goana (*Varanus*); but specimens have been obtained at Rocky River and at D'Estree Bay.

For the most part it makes its home under fallen timber or beneath boulders, and I have never seen a genuine burrow constructed by these rats on the mainland, though on Kangaroo Island most of the rats live in deeply excavated holes. They are easily taken with any bait, but they are, as a whole, rather strictly vegetarian in their diet. They are extremely gentle, easily handled even when freshly caught, and show little inclination to bite.

It would appear that they do not live in communities, and the population of even a favoured site is in reality very small. At present their head-quarters seem to be in that very characteristic part of the State between the Southern shores at Encounter Bay and Mount Moon; but I have trapped it as far afield as Coffin's Bay. In the region about Mount Moon the rat frequents the many streams which intersect the low-lying country,

and since it is not by any means abundant even there, it is likely at any time to become exterminated by closer settlement and the advent of introduced rats. It is open to doubt if the rat which was found by the Horn Expedition in the Centre and which has been described as *R. greyi*, is, in fact, the same animal as Sir George Grey obtained in 1841 and is here described from specimens trapped in Cleland's Gully.

The measurements of the rat obtained by the Horn Expedition, and as recorded by Edgar R. Waite, Director of the South Australian Museum, are inserted here for comparison with those of the typical animals from the Mount Moon district.

DIMENSIONS.

	♂	♂	♂ jun.
Head and body	146·5	140	116
Rhinarium to ear	36·1	31·5	29·8
Ear	16	15·2	13·2
Pes	29·6	27·2	26·5
Tail	121	116	111·5

DIMENSIONS OF SKULL.

Greatest length	34·5
Basal length	31
Bizygomatic breadth	19·6
Interorbital breadth	4·7
Nasals, length	11·8
Nasals, breadth	3·3
Palate length	18·4
Upper molar series	7·1

It is to be hoped that examples of this rat from various localities in the State will be captured and preserved before it is too late. Not until this is done will it be possible to determine the range of variation exhibited by this species.

(6) Pearson Island Rat.

RATTUS MURRAYI (Thomas, 1923).

The Pearson Island rat is an insular form of *Rattus greyi*. It belongs to the group of small, fluffy, white-footed native rats, and was named by Mr. Oldfield Thomas in compliment to Sir George Murray.

The specimens from which the species was named were captured on Pearson Island by the writer in January, 1923.

The original description of the type is as follows:—

"Most nearly allied to *R. greyi* of the mainland. Size about as in that animal. Fur fine and soft. General colour greyish washed with buffy brown, the grey showing through the brown more than in *R. greyi*, and the general tone consequently paler. Under surface drabby-grey, the hairs broadly slaty at base, their tips drabby-whitish; line of demarcation scarcely marked. Hands and feet white, with a certain darkening on the metopodials and digits which is not present in *R. greyi*. Tail rather

shorter than in *R. greyi*, but imperfect or diseased in most of the specimens, this being, perhaps, due to severe competition in a small island.

"Skull essentially similar to that of *R. greyi*, with similarly reduced supraorbital ridges; but the palatal foramina are more widely open and the bulla are rather larger, the latter a character one would not expect to find in an island animal. (*See* Figure 211.) Molars conspicuously smaller than in *R. greyi*, and, indeed, far smaller in proportion to the skull than

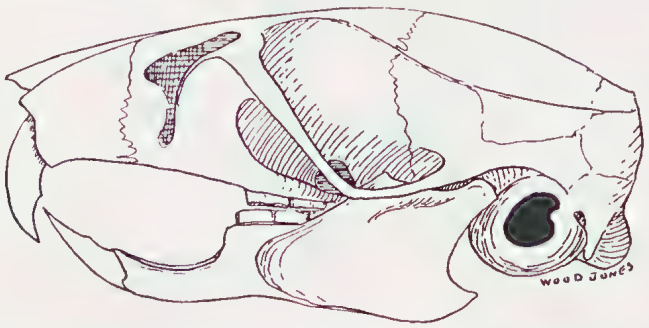

FIGURE 211.—*Rattus murrayi*. Lateral view of the skull of an adult female. Twice natural size.

in the majority of the species of *Rattus*. Dimensions of the type (measured on the spirit-specimen before skinning) :—

Head and body, 134 mm.; tail, 116; hind foot, 28; ear, 19. Skull: greatest length, 36·4; condylo-incisive length, 34; nasals, 14·6; interorbital breadth, 5; breadth of brain case, 15·2; palatal foramina, 7·6 x 3; length of bulla, 6·7; upper molar series, 5·1.

"This distinct species is readily recognizable by its pale colour, shortened tail, large bulla, and most of all, by its unusually small teeth.

DIMENSIONS
of a series of specimens from Pearson Island.

	♂	♂	♂	♀	♀	♀
Head and body	148	147	145	148	144	128
Rhinarium to ear	34	32	34	35	32	31
Ear	18	18	16·5	17 5	17	15
Pes	27·5	27·5	27·5	27	27	27·5
Tail	110	114	108	115	—	96

The long hairs of the hinder part of the dorsal region 30 mm. in length. Vibrissae to 40 mm.

DIMENSIONS OF SKULL
of a series of specimens from Pearson Island.

	♀	♂	♂	♀	♂	♀
Greatest length	37	31·5	36·5	32	37	31·5
Basal length	35	29·5	34	29	34·5	29
Zygomatic breadth	19	16	18·5	16	19	16
Interorbital constriction	5	5	5	5	5·5	5
Nasals, length	14·5	12	13·5	12	14·5	12
Palate, length	19	16·5	18·5	16·5	19	16·5
Upper molar series	5	5	5	5	5 5	5

This little rat lives almost everywhere upon the three partially detached portions of the mainland of the Pearson Group. Upon the South Island the whole of the travertine plateau is traversed by runways which lead, radiating fashion, from central burrows which usually open into a large ramifying excavation beneath a slab of travertine. The runs are well beaten down, and traps set in them never failed to catch. Upon the open travertine plateau the rats seem mainly to feed upon the *Mesembryanthemum*, and none of their hollows beneath the travertine pavement contained any store of food.

On the Middle Island, and again on the larger North Island, the bulk of the rat population is centred on the travertine plateaux; but large communities also live among the great granite boulders. Wherever they shelter during the daytime, the limestone flats, covered with pigface and low saltbush, seem to provide their nocturnal playground and their source of food. In the one spot, on the southern and eastern side of Middle Island, where there is a sandy beach, the rats also go down to the sea every night to forage over the sand above the tide mark. Although, in the deep shade of the spaces between the great granite boulders, it is usually possible to see a specimen or two in the day time, the rats are distinctly crepuscular and nocturnal creatures, and as soon as dusk comes the travertine plateaux become alive with them.

The animal proved to be ridiculously easy to trap, and in this it showed a very marked contrast to *Leporillus jonesi*, on Franklin Island. Cage traps set about the camp could be emptied and reset several times during the evening, and almost any bait—oatmeal, cheese, bacon, or bread—seemed to attract the rats. Those brought back alive lived well in captivity and proved to be very gentle and contented little animals; but, unfortunately, they did not breed. As in the case of some other animals observed in the islands, the males seem to vastly outnumber the females, and a very large proportion of the rat population shows varying degrees of mutilation of the tail. The general appearance of *R. murrayi* is very characteristic; its small size, fluffy coat, and small white hands and feet make it an attractive little animal. It is also remarkably gentle, and freshly-caught animals can be handled, if they are not unduly alarmed or roughly grasped, without fear of their biting. They thrive on any vegetable diet, but seem to be short lived, none of them remaining alive a year after capture, and all of them showed well-marked signs of old age before they died.

Since Pearson Island has been proclaimed a sanctuary under the Act of 1919, there is every hope that this insular rat will remain unmolested in the home which shelters not only it and the unique Rock Wallaby (*Petrogale pearsoni*), but is also the stronghold of the South Australian Hair Seal (*Arctocephalus cinereus*).

(7) Long-haired Rat.

RATTUS VILLOSISSIMUS (Waite, 1898).

The Long-haired Rat was for many years known as *Mus longipilis* (Gould, 1863), but this name, being preoccupied, was changed by Waite when he described fresh examples from Central Australia. From this last author the following description is taken:—Fur, long, close, harsh, generally of a sandy colour but apparently darker owing to the numerous black hairs which are mostly tipped with white; the colour at the base of the hairs of the dorsal surface is dark grey, those of the ventral surface being somewhat lighter. Manus and pes clothed with white hairs. Tail not so long as the head and body, and the hairs are short, black and stiff; the scales average ten to the centimetre. Nipples, four thoracic and six abdomino-inguinal.

DIMENSIONS.

	♂	♀
Head and body	153	163
Rhinarium to ear	33·4	36
Ear	20·2	20·5
Pes	34	30·6
Tail	144	147·5

DIMENSIONS OF SKULL.

	♂	♀
Greatest length	42·5	41·1
Basal length	37·8	37·5
Bizygomatic breadth	—	20
Interorbital constriction	5·7	5·2
Nasals, length	15·9	15
Palate length	22·9	22·3
Upper molar series	8·2	7·8

The rat is an inhabitant of Central Australia and probably lives within the northern limits of this State. It appears that this striking and distinct species is rare, and it is much to be hoped that the advent of the fox in its territory has not lead to its extermination.

Introduced Members of the GENUS RATTUS.

It is rather a curious fact that none of the native rats are of any economic importance as hinderers of human enterprise, destroyers of property, or even, as far as is known, as carriers of disease. They are a harmless set of animals, existing in small numbers and leading obscure and unobtrusive lives.

It is quite the reverse with the two introduced members of the genus, the Brown or Norway Rat (*Rattus norvegicus*) and the Black and Alexandrine Rat (*R. rattus*). Of these, if choice must be made of animals

which have little to recommend them from any point of view, the most noxious in Australia is *R. rattus*. There is a great deal of confusion concerning these introduced rats, since the commonest form of the Black Rat is not black, and is, in fact, of a lighter brown colour than the Brown Rat. The two species are, however, readily told apart, and the following table comprises the main features of habit, and specific characters most useful in distinguishing them:—

Brown or Norway Rat. (*Rattus norvegicus*).	Black and Alexandrine Rat. (*Rattus rattus*).
Lives under floors or in drains when in human habitations.	Lives in roofs, and not as a rule under floors.
Lives along watercourses and is often semi-aquatic when living in the open.	Lives in gardens, or orchards.
Prefers to burrow and live in the ground.	Not given to burrowing into the banks of ditches.
Is not a great climber.	Is a great climber and often lives in trees.
Is a general scavenger, fond of animal food.	More of a vegetarian with a liking for fruit.
Is heavily built and compact.	Is lightly built and more graceful.
Ear short, thick, and not quite reaching the eye when turned forward.	Ears large, thin, and reaching the middle of the eye when turned forward.
Feet robust.	Feet rather slender.
Tail not so long as the head and body.	Tail as long as, or longer, than the head and body.
Skull with a straight-sided brain case as seen from above.	Skull with a rounded brain case as seen from above.

Only brief descriptions of the species need be added.

(1) Brown Rat, Norway Rat.

RATTUS NORVEGICUS (Erxleben, 1777).

The Brown Rat is an introduction from the northern temperate portions of Europe. It is a heavily built, sturdy, creature of a general brownish colouration, the back being a mixture of ochraceous-buff and slaty-grey with somewhat lighter sides and a greyish-white ventral surface. The pelage is rather coarse, and older specimens have a somewhat rough appearance. The manus and pes are coloured like the ventral surface. The tail is rather short and stout, the hairs on it so sparse that the scales everywhere are visible on the surface. The skull has a long, narrow, straight-sided brain case. (*See* Figure 212.) The Brown Rat is a great fighter and a

marvellously powerful creature for its size. In Australia its zoological importance consists in this pugnacious disposition, for wherever it encounters the harmless native rat population, the native animal is doomed. This even seems to apply to so large a creature as *Hydromys*, which disappears before the invading Norway Rat as this species takes possession of the banks of creeks and rivers.

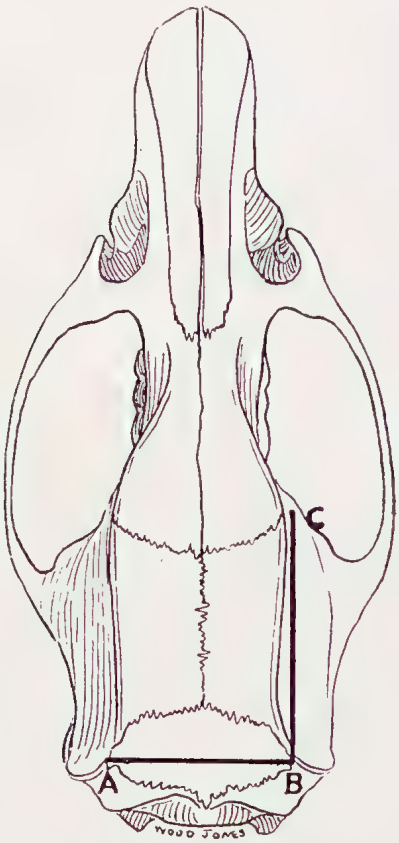

FIGURE 212.—Dorsal view of the skull of *Rattus norvegicus*. Twice natural size. Note that the breadth of the interparietal (A–B) is less than the length of the side of the parietal (B–C).

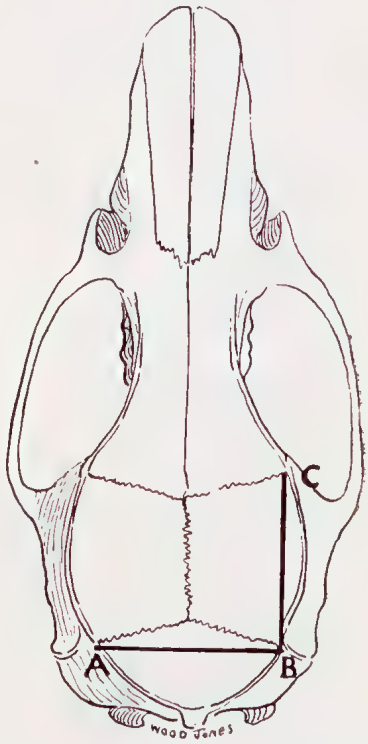

FIGURE 213.—Dorsal view of the skull of *Rattus rattus*. Twice natural size. Note that the breadth of the interparietal (A–B) is equal to, or greater than, the length of the side of the parietal (B–C).

Strangely enough it seems unable in Australia to follow up its successes of ousting the Black Rat as it has done in Northern Europe; in South Australia, at least, the Alexandrine Rat can hold its own everywhere it meets the Brown Rat. Although it causes enormous economic havoc, damaging and spoiling more than it actually destroys, it is probable that, taking Australia as a whole, the future will regard its introduction as being a curse in no way to be compared with that of the Alexandrine Rat.

To the zoologist it will always be an object of dislike. If a likely spot along a creek is selected and traps are set, the capture of a single Brown Rat is enough to tell that the interesting native rats are gone for ever, and this in spots remote from human habitation.

Of the other introduced member of the genus *Rattus*, there are two forms, so distinct as to be a constant source of confusion. One form has its home in Europe north of the Mediterranean, and the other around the Mediterranean and to the south. In Australia these forms live side by side.

The pale form is often confused with the Brown Rat, since it resembles that animal somewhat in colouration; and this confusion is increased by the fact that the black form of *R. rattus* and the pale form may be found living together with *R. norvegicus* in the same wheat shed. On the West Coast of this State I have seen all three rats in the kill when a wheat shed was cleared for shipping, and the pale forms of the Black Rat have then been regarded locally as Brown or Norway Rats.

(2) Black Rat, Old English Black Rat.

RATTUS RATTUS (Linnaeus, 1758).

Form slender, general build light. Head slender, muzzle pointed. Ear relatively large, when laid forward extending to about the middle of the eye. Colour slaty with the back darker, often quite black. The coat is smooth, and the hairs have a gloss which gives the animal a sleek appearance when it is in good condition. The skull shows a more rounded brain case than that of *R. norvegicus*. (*See* Figure 213.) Its home is Europe north of the Mediterranean area, from which it is being everywhere ousted by *R. norvegicus*.

(3) Ship Rat. Tree Rat.

RATTUS RATTUS ALEXANDRINUS (Geoffroy, 1803).

Form as in the black type, but the colour variable shades of light greyish brown with the ventral surface in strong contrast, pale buff, white with a slightly yellowish tinge, or pure white. Its home is the Mediterranean area, from which it shows no tendency to be ousted by *R. norvegicus*. In America, to which both forms have spread, a geographical distribution of the types is shown as it is in Europe, the black type extending further north than the pale type. In Australia this zoning of distribution does not seem to occur, and black and grey seem to be intermingled everywhere, and, probably because of this, intermediate types are very common, there being the widest range of colour among the specimens captured in any given area. It is probably in consequence of this variability, and the fact that the rat has become so thoroughly a "bush" rat, that Australian zoologists have so often failed to realise that animals submitted to them are introduced *R. rattus alexandrinus* and not real native rats. The failure to recognise this imported rat under its many guises has added considerable difficulty to the study of the true Australian rats, since various zoologists have re-christened it on several occasions. In fact, Messrs. Higgins and Petterd in the eighties re-christened it in Tasmania on several occasions. Not only has it been so frequently re-named, but,

as the following conservative list, drawn up by Mr. Troughton, of the Australian Museum, Sydney, will show, it has been assigned to a great number of different genera. In Australia alone it has been given the following names:—

(1) *Hapalotis arboricola* (Krefft, 1863).
(2) *Mus arboricola* (Waite, 1897).
(3) *Hapalotis personata* (Krefft, 1867).
(4) *Mus novae-zealandiae* (Butler, 1879).
(5) *Mus griseocoeruleus* (Higgins and Petterd, 1883).
(6) *Mus variabilis* (Higgins and Petterd, 1884).
(7) *Mus tamarensis* (Higgins and Petterd, 1884).
(8) *Hapalotis thomsoni* (Ramsay, 1882).
(9) *Conilurus personatus* (Ogilby, 1892).

The Black and Alexandrine Rats are active, lightly-built, creatures, and are mainly vegetarian. Added to this is the love of the Alexandrine Rats for warm climates. Australia has proved an ideal home for them, and offers even more attraction to them than it does to *R. norvegicus*.

The Brown Rat does its damage in stores and warehouses, it causes economic loss by spoiling goods, by eating holes in bags and crates, and by soiling merchandise laid up in depots. The Alexandrine Rat goes further than this; it climbs trees and eats and damages fruit, it spoils crops, eats young shoots, and lives in the high piles of the wheat sheds. It has become a suburban garden pest, a threat to the orchardist, and has added these activities to the old rat rôle of being the curse of the warehouseman and the merchant. In addition to this it is essentially the ship rat, carrying on its depredations afloat as well as ashore; and, a visitor to all ports in the world, is the host of the parasite of plague. The Alexandrine Rat is now familiar to the dweller in the suburbs of Adelaide as a destroyer of fruit, and to the whole of Australia it represents as an annual loss a sum of money a tithe of which would endow scientific research on the Mammals of Australia for ever.

On several occasions rats have increased to an extraordinary extent in Australia, and have swept across the country as a veritable plague. Professor Cleland has collected details of most of these plagues, which are truly remarkable occurrences. The first visitation of which there is a record is that which took place in the Darling country in 1864. In 1869-70 a great plague of rats occurred in the North-western plain country of Queensland. The numbers of the rats were incredible; Mr. E. Palmer, who was in the district during the plague, asserted that "fifty thousand square miles occupied by these animals, and one rat to every ten square yards in each mile would not represent anything like their number." Exactly what species of rat it was that multiplied to such a remarkable extent, is not recorded, but in most of the later plagues the hordes were composed of *R. rattus alexandrinus*.

In 1887, rats swept down Cooper's Creek. The animals advanced from the North and devoured everything edible that came in their way, and destroyed what they did not devour. The hordes were moving in a south-westerly direction; they came suddenly and as suddenly disappeared. In 1904 again, rats swarmed over the Northern areas and again they moved in a south-westerly direction. They invaded Alice Springs in September and later moved in the general direction of Cooper's Creek. At the various places through which they passed they wrought wholesale damage. Everything made of leather had to be hung up in box trees, and provisions were suspended from branches; even then it was difficult to keep a pair of boots or a saddle, so great was their liking for leather, especially if it had been greased. They swarmed to such an extent that it was almost impossible to sleep, for the rats invaded the blankets of the sleeper in order to find a meal. Cases in which a man's fingers, toes or ears were nibbled were common. The rats died in countless numbers. They perished for want of water, they died of starvation, they piled themselves against the netting fences in masses, they bred at an incredible rate—and suddenly they disappeared and passed on.

Genus 2.—PSEUDOMYS (Gray, 1832).

This genus of small rats is confined to Australia and Tasmania, the range of the genus not extending to New Guinea. Many of the species are commonly known as mice; but the mice of this genus are distinct from the mice of the genus *Mus*. So far as is known, no member of the genus possesses thoracic nipples; in all cases where examination has been made the nipples are restricted to the abdomino-inguinal region and are four in number. The skull is not heavily built and is quite without supra-orbital ridges. The interorbital region is narrow, parallel-sided, with more or less rounded edges. The genus contains some twenty species, which, since their characters are not uniform, are distributed among four sub-genera.

Sub-Genus 1.—Pseudomys *sens. strict.* (Thomas, 1910).

Size large. Posterior nasal region of skull flat or even concave. Anterior roots of zygoma projecting boldly with its front edge concave. Palatal foramina large. Molar teeth high, with heavy cusps. Only one member of the genus inhabits South Australia.

Long-eared Rat.

Pseudomys auritus (Thomas, 1910).

This rat was confused by Gould with an allied form and was separated and re-described by Oldfield Thomas. From this re-description the following account is taken.

In size the rat is the largest member of the genus, and is distinguished from the other members by its exceptionally long ears. The fur is long,

soft and thick, the wool-hairs of the dorsal surface about 14mm. in length, the longer hairs surpassing them by about 4.5 mm. General colour dark fawn-grey, heavily darkened on the back by the blackish tips of the longer hairs. Ventral surface soiled buffy, the hairs dark slaty for two-thirds of their length, their ends "pinkish buff"; no line of demarkation separates the colour of the dorsal surface from the paler ventral surface. Ears very long; black with greyish white tips and greyish white hairs clothing the backs. Manus and pes silvery white. Tail well haired, brown above, white below.

DIMENSIONS.

Head and body	130
Ear	26
Pes	32
Tail	125

The measurements are taken from a mounted specimen.

The skull is larger than that of any other member of the genus and the teeth are fairly broad.

DIMENSIONS OF SKULL.

Greatest length	35·5
Basalar length	30
Bizygomatic breadth	28·5
Interorbital breadth	4·5
Nasals, length	14·8
Palate length	18
Upper molar series	6·3

The specimen from which this description was written was an old one, being received by the British Museum in 1853. It came from Lake Albert. There seems to be no more recent evidence of its existence; but intensive collecting in the region of the Lakes would be well worth undertaking.

Sub-Genus 2.—THETOMYS (Thomas, 1910).

The rats belonging to this section are smaller than those included in the Sub-genus *Pseudomys*, and from them they are distinguished by the more normal form of the skull, which lacks the post-nasal flattening. The anterior root of the zygoma is only slightly concave on its anterior margin.

Two members of the genus are included in the fauna of South Australia.

(1) Little Rat.

PSEUDOMYS (THETOMYS) NANUS (Gould, 1857).

The species was originally described by Gould and additional details were supplied by Waite in 1898 when describing specimens from Central Australia. The rat is a diminutive one with coarse hair and a somewhat short tail. The head, dorsal surface, and outer side of limbs, chestnut brown with numerous fine black hairs intermixed. The ventral surface

greyish white, becoming much lighter and forming a conspicuous patch immediately beneath the tail. A dark mark is present on the fore limb, mainly on the outer side. The basal portion of all the hair bluish grey. Ears short, sparsely clothed with hairs. Facial vibrissae black. Manus and pes light brown. Tail usually a little shorter than the head and body, the scales averaging fifteen to the centimetre, sparsely clothed with brown hairs. Nipples four in the abdomino-inguinal region.

DIMENSIONS.

	♂	♂	♀	♀
Head and body	85	80	96	76·4
Rhinarium to ear	25	24·1	24·5	22·7
Ear	11·2	10·5	11·6	10·2
Pes	21	20·4	21·7	20·5
Tail	82	90	94·5	86

The skull is arched, the nasals bent downwards.

Anterior root of zygoma slightly concave.

DIMENSIONS OF SKULL.

	♀
Greatest length	26·2
Basal length	22·6
Zygomatic breadth	14·3
Interorbital constriction	3·7
Nasals, length	9·3
Palate length	14
Upper molar series	5 2

All the above measurements are taken from Waite's 1898 description.

Although originally described from Western Australia, the species appears to have a wide range in the Centre, specimens having been obtained from Wycliffe Creek, Barrow Creek, and Alice Springs. It probably extends its range to the South into this State, but there is no recent information concerning it.

(2) Gould's Rat.

PSEUDOMYS (THETOMYS) GOULDI (Waterhouse, 1839).

This rat was described by Waterhouse from a specimen from New South Wales, and Gould subsequently gave details of examples from the Coorong. The original description of Waterhouse is utilised here.

General colour pale ochreous yellow; on the back there are numerous long black hairs interspersed with the ordinary fur, which gives a darker hue and a somewhat variegated appearance to that part. The chin, throat, manus, and pes, and the whole of the ventral surface of the body white. The hairs of the dorsal surface are of a deep lead colour at the base, pale ochre near the apex and with the tip itself dusky. The longest

hairs are black. The hairs of the ventral surface are deep grey at the base and broadly tipped with white. The ears are rather large and slightly pointed; they are brown in colour, sparingly clothed with minute yellow hairs, excepting at the tip, where they are brownish. The tail is slender and tolerably long, brownish above, yellowish white beneath. The facial vibrissae are long and coloured brown. Waterhouse notes another colour variety in which the whole animal was somewhat paler, the white of the ventral surface extending to the sides of the body, and the dorsal hairs being palish grey, instead of deep lead colour, at the base. Gould described the general colour as buffy brown, interspersed on the dorsal surface with numerous long black hairs. The ventral surface, according to him, is pale buffy white, washed with a deeper tint of buff on the cheeks and lower portion of the sides. He believed this species to be identical with *Rattus greyi*.

DIMENSIONS.

	Waterhouse.
Head and body	119
Rhinarium to ear	26
Ear	14·5
Pes (with claw)	26
Tail	89

So far as South Australia is concerned, *Pseudomys* (*Thetomys*) *gouldi* seems to be a lost animal, and it is not impossible that the rat found along the Coorong, which Gould noted, was a species different from the Western Australian form described by Waterhouse. In 1896 Waite described some rats obtained by the Horn Expedition in Central Australia. These agreed with the description given by Waterhouse of *P. gouldi*, but they were considerably smaller. The measurements of this doubtful form, as given by Waite, are as follows:—

DIMENSIONS.

	♂	♂	♀	♀
Head and body	83	84·3	91	88·5
Rhinarium to ear	21·8	21·6	21·8	21·6
Ear	10·5	11·8	11·2	12
Pes	16	16	17·8	17·7
Tail	60	—	67	77·2

DIMENSIONS OF SKULL.

	♂	♀
Greatest length	24·8	24·8
Basal length	22·1	22·2
Zygomatic breadth	13·3	14
Interorbital constriction	8·3	9
Nasals, length	8·5	9
Palate length	13	13·8
Upper molar series	5	4·6

As with so many of our native rats, it is impossible to be certain of the status of this Central form until more material is available for study; and Gould's small rat, with white under parts and white feet is an animal that all those interested in Australian zoology should be on the look out for.

Sub-Genus 3.—Leggadina (Thomas, 1910).

The species included in this sub-genus are smaller than those embraced in *Thetomys,* and they differ from that sub-genus in the fact that the anterior root of the zygoma is usually straight, as well as in some more specialized details of the skull and teeth. Two species of these small rats inhabit the northern part of this State or live just beyond its northern border.

(1) Field's Rat.

Pseudomys (Leggadina) fieldi (Waite, 1896).

This little rat was one of the discoveries made by the Horn Expedition, and it was named in 1896 by Waite after Mr. J. Field, of Alice Springs. The following account is taken from Waite's original description of the species. Size medium, fur of moderate length, remarkably fine and fluffy. General colour warm sandy brown, the head being a little darker; cheeks and sides brighter in colour, the whole of the under surface pure white. Hairs of the dorsal surface dark grey at the base, those of the ventral surface pale grey. Ears large, almost naked within; when laid forward they reach the centre of the eye. Limbs pale sandy colour. Manus and pes white. Tail thin and very long; considerably exceeding the length of head and body. There are a few short sandy hairs on the upper surface of the tail, becoming darker towards the tip, which is black. The tail is clothed with white hairs below. At the tip of the tail the hairs are longer and hide the scales, which are visible elsewhere, and average fourteen to the centimetre. The nipples are four in number and abdomino-inguinal in position.

DIMENSIONS.

	♀
Head and body	103·5
Rhinarium to ear	26·7
Ear	18·5
Pes	23·5
Tail	122

The skull of the type specimen was so badly crushed that no cranial measurements were obtainable.

Like so many of the animals discovered by the Horn Expedition, Field's Rat remains known only from the original specimen then obtained. In the last thirty years little or nothing has been done to follow up the success of that scientific expedition, or even to fill in the gaps which render incomplete some of the knowledge then gained.

(2) Desert Mouse.

PSEUDOMYS (LEGGADINA) HERMANNSBURGENSIS (Waite, 1896).

This mouse, which must not be confounded with the kindred of the House Mice contained in the Genus *Mus*, is a Central Australian form, and was one of the discoveries of the Horn Expedition. The account is taken from the original description given by Waite.

The size is a little smaller than that of the House Mouse. The fur is soft, with an admixture of longer hairs. General colour warm brown, darker on the back, becoming lighter on the sides, where it merges into yellow. Below the eye and ear the colour is somewhat lighter than that of the rest of the body. The hairs of the dorsal surface are dark grey at the base. Ventral surface white; the hairs of the ventral surface being pale grey at the base. The ears are large, pale within, well clothed with whitish hairs; laid forward they reach the posterior third or centre of

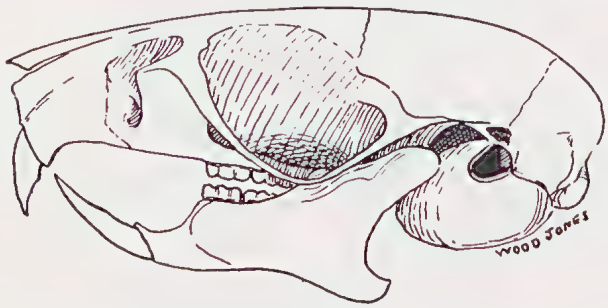

FIGURE 214.—Lateral view of the skull of an adult male *Pseudomys* (*Leggadina*) *hermannsburgensis*. Three times natural size.

the eye. The front of the fore and hind limbs yellow; manus and pes pale yellow. Tail longer than the head and body; uniform brownish-grey above, sides and under surface white; the hairs are short, leaving the scales well exposed, averaging eighteen to the centimetre. Nipples four in number and abdomino-inguinal in position.

DIMENSIONS.

	Measurements by Waite.				
	♂	♀	♀	♀	♀
Head and body	69·5	79	78	78	76
Rhinarium to ear	19	19	19	19·7	19
Ear	11	11·5	11·5	12·5	11
Pes	17	17	17·5	17	17·5
Tail	80	85	81·5	83	80

Although the animal is smaller than a large specimen of the House Mouse, the skull is considerably larger; and it may be readily distinguished from that of the introduced animal by its rounded brain case and elongated, slender, nasal region. (*See* Figure 214.)

DIMENSIONS OF SKULL.

	Measurements by Waite.	
	♀	♀
Greatest length	23	22·6
Basal length	19·3	19·5
Zygomatic breadth	12·5	12
Interorbital constriction	3·5	3·4
Nasals, length	7·4	7·2
Palate length	13	13
Upper molar series	3·2	3·8

This little mouse has a wide distribution in the Centre. The original specimens came from Hermannsburg, Central Australia, where it is known to the natives by the name "Menkie"; but it also occurs at Ooldea, where Mr. A. G. Bolam has observed it living in the arid country of the Nullarbor Plains. The form that lives around Ooldea is slightly larger than the type specimens. The following measurements are of examples captured at Ooldea by Mr. Bolam:—

	♂	♂	♀	♂
Head and body	80	85	75	78
Rhinarium to ear	20	22·5	21	20
Ear	15	14	14·5	14
Pes	17	19	15	17·5
Tail	82	90	86	82

Sub-genus 4.—Gyomys (Thomas, 1910).

The mice included in this sub-genus differ from those of the Sub-Genus *Leggadina* only in a rather specialised detail of the dentition. Of the three species contained in the Sub-genus one has been recorded from Queensland, one from New South Wales, and the third from Western Australia. So far, no member of the Sub-genus *Gyomys* has been recorded from this State.

Genus 3.—MUS (Linnaeus, 1758).

The true mice belonging to the genus *Mus* are all small animals, and they are readily distingiushed from the members of the other Murine genera by two specializations of the teeth. In the first place, the upper incisors, instead of being bevelled at their cutting edge like a chisel, are notched on their posterior surface by the wearing caused by the lower incisors. (*See* Figure 215.) This is a very characteristic feature, and it may be appreciated by merely opening the animal's mouth by parting its lips. There is no need for dissection or for the preparation of a skull, and every field naturalist should be able to distinguish a specimen of the very variable mice of this genus from those of the truly Australian forms

embraced in the genus *Pseudomys*. In addition to the notched edge of the upper incisor teeth, there is this great difference in the molars; whereas

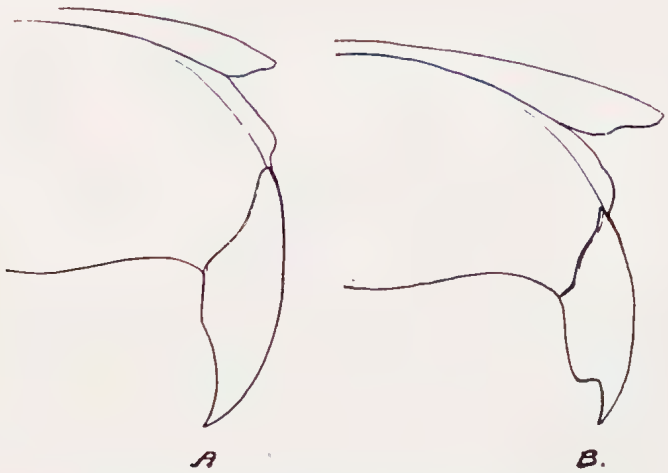

FIGURE 215.—Incisor teeth of (B) members of the genus *Mus* contrasted with (A) the usual murine incisors.

in the other genera the first molar is only slightly larger than the other two molar teeth, in *Mus* the first molar is so disproportionately large that its length exceeds that of the other two combined.

House Mouse.

MUS MUSCULUS (Linnaeus, 1758).

The introduced House Mouse lives everywhere in Australia. It lives in towns as well as in far away homesteads, and has extended its range to the gibber plains, the sandhill country, and to the blue bush and salt bush areas, miles away from the nearest human habitation. From Lake Phillipson to Oodnadatta in the North to the Coorong and Kangaroo Island in the South, I have caught mice set in traps in the open. It must always be remembered by the field naturalist that some of the rarer native murines are so extremely like House Mice in general external characters, that it is always necessary to examine a mouse with great care. No mouse should ever be discarded until a careful examination has been made of its upper incisor teeth. A specimen that looks like a common mouse but which has unnotched upper incisors should always be carefully preserved.

The House Mouse in Australia is also an extremely variable animal, which shows a wide range of variation in its measurements and in its colouration. Traps set near to each other will commonly catch some mice that are coloured a uniform dull brown and others that are yellowish brown on the dorsal and white on the ventral surface. It must be borne in mind that there are in Europe some half-dozen recognised species and sub-species of the *Mus musculus* group, and that the Australian stock is probably a mixed one.

The most noteworthy Australian variation from the typical form of *Mus musculus* is the remarkably small, dark mouse that inhabits the open stony tablelands of the North. A series of these little mice was first obtained at Miller's Creek. They differ from the typical form only in size and cranial form, for many of the more normally sized mice of the interior are quite as dark in colour as are these little ones. The dimensions of a typical pair are as follows:—

	♂	♀
Head and body	60	55
Ear	10	9
Pes	15	14
Tail	65	58

These measurements may be contrasted with the average of seven specimens from London recorded by Gerrit Miller.

	Average.	Extremes.
Head and body	78·4	75–84
Pes	17·3	16·6–18
Tail	78·6	76–88

The skull is equally small, the measurements being as follows:—

	♂	♀	London Specimen (Miller).
Basal length	17	16	20·6
Zygomatic breadth	10	9·5	11
Interorbital constriction	4	4	3·6
Nasal, length	6	5·5	7·8
Upper molar series	3·5	3	3·6

It will be noticed that although the skull is considerably smaller than that of the London mouse, it is actually broader between the orbits. This gives the skull a very characteristic appearance, for it tapers more uniformly from the rounded brain case to the nasal region and lacks the well-marked constriction, which separates the cranial from the nasal region in the typical form. This small dark mouse does not occur in the more fertile districts of the South and it appears to be a definite desert form.

The typical House Mouse of North-western Europe has the ventral surface only a little lighter in colour than the dorsal surface, but in Australia it is extremely common for the ventral surface to be pale buffy, pale yellowish, or even practically white. These white-bellied mice are intermixed with the more normally coloured individuals, and the two forms may be trapped at the same time in the same pantry. On the whole, *Mus musculus* is a far more outdoor animal in Australia than it

is in England, and, under normal conditions, it is quite content to live in the open, whether it be a town or a country dweller.

At times the mice undergo a remarkable increase in their numbers, and one of the periodic mouse plagues results.

Professor Cleland has collected the records of many of these visitations. One bad plague occurred in 1903, 1904, and 1905. The vast hordes were migratory, and moved, as an ever increasing army, in a general south-westerly direction from Queensland to Adelaide.

The numbers involved in this plague were immense, and the rate of reproduction altogether phenomenal.

During this vast migration the hordes appeared, multiplied, and disappeared at any given place over a period of some four months. It was notable that the individuals composing the whole army were extremely variable, both in colour and size, and that, although extremely vigorous at the beginning of the migration, they became miserably poor and diseased towards the end. In 1911 the northern portions of this State were again visited, and again the army advanced in a general south-westerly direction. In December, 1916, mice became extremely numerous in New South Wales. In Victoria they began to increase in February, 1917. In South Australia they first became conspicuous in March. In Western Australia there was no notable increase in the numbers of the mice. Although there is evidence in all these plagues that the actual army of mice migrates, there is evidently another factor involved. The rate of multiplication increases locally at a remarkable pace. There is an increased fertility among the mice, and this increase of fertility seems to advance as a wave. This strange fact is made clear by the curious circumstance that when mouse plagues have reached the south of South Australia, Kangaroo Island has become affected, not by an actual influx of mice, but by a local plague, due entirely to the abnormal increase of the local mice. As regards the numbers of mice present during a mouse plague, some idea can be gathered from the official statement that when measures were taken to rid the wheat stacks of mice, "Mr. England caught some 36 million late in the season, and the wheat inspector agreed that twice as many could have been caught earlier."

This is not the place to dwell on the incalculable damage done by mice, nor on the diseases which they spread, but they certainly vie with the introduced rats (*R. norvegicus* and *rattus*) in costing Australia a fabulous sum for the damage that they do.

Genus 4.—MASTACOMYS (Thomas, 1882).

This very distinct genus is founded upon the remarkably broadened molars which characterise the only living member. The first molar tooth is so broad that it is half as wide again as the palatal interspace which separates it from its fellow of the opposite side. The genus is as yet only

known from one Tasmanian example, the type of *M. fuscus* (Thomas, 1882), one immature specimen from Victoria and some cave remains from the Wellington Caves, New South Wales. Some young rats obtained by the Horn Expedition in Central Australia were at first taken to be members of this genus, but after further material was examined, Waite ascertained that the animals were in reality very young specimens of *Pseudomys (Thetomys) nanus,* and the hopes that the animal was still living were not fulfilled. More recently the writer obtained some remains of a representative of this genus from a guano cave at Mount Gambier.

The animal represented by these fragments obviously differed from those previously found living or dead in Tasmania, Victoria, or New South Wales, and it was named by Oldfield Thomas.

Mastacomys mordicus (Thomas, 1922).

The original description is as follows:—"Size, as gauged by teeth, only about three-fourths of that of *M. fuscus.* Teeth quite similar in structure to those of that animal.

Skull apparently lower in proportion, at least anteriorly, the zygomatic plate measuring in height only about 5.7 mm. from the upper bridge to the lower end of the foramen, while in the type of *fuscus* this measurement is 6.9 mm. Anterior edge of plate deeply and abruptly cut out to a depth equal to half its height, that of *fuscus* only evenly but slightly concave.

The molar roots are as follows:—M^1, a large intero-external, a small postero-external, and two smaller inner, near together, therefore four in all; m^2, four subequal roots, placed in a square; m^3, three roots, two large anterior level with each other, and a large median posterior.

Length of the molar tooth-row, alveolar 9.1 mm., grinding surface (unworn) 7.2 (respectively 10.1 and 8.5 mm. in *M. fuscus*); greatest breadth of m^1 3.0.

While the Eastern forms from New South Wales and Tasmania are all of about the same size, this South Australian species is readily distinguished by its much smaller dimensions.

Whether it is still to be numbered among the recent fauna of South Australia remains to be proved."

It would be one of the romances of zoology if our field naturalists in the South-East should ultimately find this animal to be still living. In the cave deposit in which its remains were found are the remains of other species which still survive, and the quest for a living specimen should not be regarded as hopeless.

Genus 5.—LAOMYS (Thomas, 1909).

This genus contains two remarkable rats which are very unlike most members of the family *Muridae* in general appearance. They are medium sized rats, with rather short compact bodies and crisp, almost spinous

coats. The feet are short and broad. The tail is short, thickened at the base, tapering towards the tip, and freely covered with hair throughout. One species is probably a member of the northern fauna of this State.

Thick-tailed Rat.

LAOMYS PEDUNCULATUS (Waite, 1896).

This curious rat is one of the many zoological discoveries made by the Horn Expedition. The rat is easily recognised by its remarkable incrassated tail. The fur is long, thick and harsh, especially on the back. The general colour is yellowish brown. The basal three-fourths of the individual hairs grey, succeeded, some by yellow, some by brown, and many of the longer ones are tipped with black. Muzzle and face grey. The hairs on the sides of the body are not brown at the tip, and the general colour is, therefore, yellowish, fading into white below. The white hair extends along the whole of the ventral surface. The hairs on the mid line of the ventral surface are white at the roots, those on the sides are pale grey. The ears are large, clothed with short golden hairs within and without. Laid forward they reach the centre of the eye. Limbs paler than the back. Manus and pes ochraceous, with the digits white. A dark line passes from the heel along the outer side and advancing upwards along the middle line of the pes, disappears before reaching the base of the digits. A similar line is traceable on the manus. Tail slightly longer than the head and body. At its base and for a centimetre onwards it is of normal thickness (about four millimetres), whence it suddenly swells to twice that diameter, its lateral slightly more than its vertical thickness; continuing for this size for some distance, it gradually diminishes in diameter. The hairs of the tail are long and quite conceal the scales; the individual hairs are very coarse and stiff near the base, but towards the tip they become finer and longer, the tip itself being pencilled. On the dorsal surface, the tail is yellow, with some black hairs interspersed. These black hairs become more numerous towards the tip and eventually displace the yellow ones. The sides of the tail are yellow, the ventral surface white. The scales average twelve to the centimetre. The nipples are four in number and abdomino-inguinal in position.

DIMENSIONS.

Measurements by Waite.

	♂	♂	♂	♂	♀
Head and body	133	117	121	117·5	127·8
Rhinarium to ear	33·5	33·1	33·3	31·3	31
Ear	18·5	18·2	18	17·5	17·5
Pes	28·5	27·7	28·3	26·7	25·2
Tail	138	—	—	—	—

So many of the original specimens had imperfect tails, that it was impossible to obtain complete measurements. This lack of detail was, however, rectified upon the receipt of another batch of specimens, and Waite has recorded the tail length in these specimens as follows:—

	♂	♂	♂	♀
Head and body	118	117	115	92
Tail	121	120	122	97

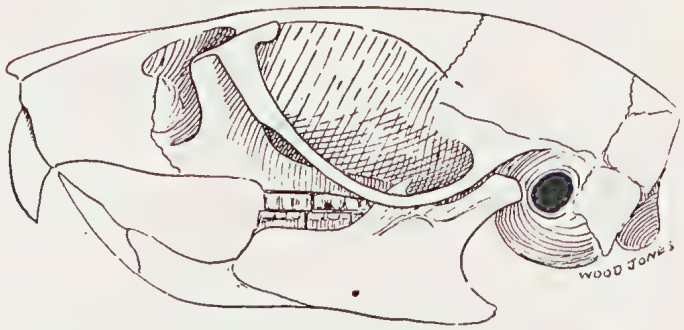

FIGURE 216.—*Laomys pedunculatus*. Lateral view of the skull of an adult male. Twice natural size.

The skull is rather delicate in build. (*See* Figure 216.) The anterior root of the zygoma large and concave along its anterior margin. Nasal region elongated and narrow. Bullae rather small. Incisor teeth orange, stout and strongly curved.

DIMENSIONS OF SKULL.

Measurements by Waite.

	♂
Greatest length	37·4
Basal length	31·4
Zygomatic breadth	18
Interorbital constriction	5·3
Nasals, length	13·8
Palate length	19
Upper molar series	6·6

Two of the original seven specimens examined differed from the rest in possessing smaller ears and in one or two other characteristics. These short-eared specimens constitute a definite sub-species.

LAOMYS PEDUNCULATUS BRACHYOTIS (Waite, 1896).

The ears reach only to the posterior margin of the eye when laid forwards. The tail is shorter than the head and body. Although thickened as in the typical form, the degree of incrassation is less. The tail is destitute of yellow hairs, being black above and white below. At the base of the tail the hairs do not hide the scales. The scales average seventeen, instead of twelve, to the centimetre.

DIMENSIONS.

	♂	♀
Head and body	110	112
Rhinarium to ear	30·6	30·8
Ear	15·2	15
Pes	26·1	26·2
Tail	—	108·2

DIMENSIONS OF SKULL.

	♂
Greatest length	35·3
Basal length	29·2
Zygomatic breadth	17·4
Interorbital constriction	5·1
Nasals, length	12·8
Palate length	17·8
Upper molar series	6·6

Measurements by Waite.

These remarkable rats were obtained at Illamurta and at Alice Springs, and I know of no records of their occurrence actually within the limits of this State. The curious thickening of the tail is reminiscent of that seen in *Dasycercus cristicauda,* a marsupial which inhabits the same area. The most remarkable thing about the tail is, however, its fragility. Out of the original seven specimens, only two possessed complete tails, and one showed a second incomplete break. In the second batch of specimens examined, one had suffered fracture, and reunion had taken place with the fractured portion twisted out of its proper direction. The tail appears to be brittle, as are the tails of some lizards, and many were broken in the action of catching the animals. The proportion of the sexes is evidently very unequal, for the males preponderate by eight to three. There seem to be no observations recorded on the habits of the animal in a state of nature.

Genus 6.—LEPORILLUS (Thomas, 1906).

The rats included in this genus are large, and are compact, long-eared, blunt-nosed animals. The hind limbs are not modified for jumping and the pes is large and unspecialized, having the six typical sole pads. The skull is large and stoutly built; supraorbital ridges are absent. The first and second upper molar teeth each with two internal cusps; the postero-internal cusps being absent. The first and second lower molars concave behind, the concavity being occupied by a small cusp. (*See* Figure 217.)

The rats of this genus are gregarious, and both species of which the habits have been adequately studied are communal house builders. The genus is an old established Australian one, *Leporillus* remains being

abundant in cave deposits at Buckalowie, in the North, and Mount Gambier, in the South. In these cave deposits the rats are associated with the extinct marsupial *Thylacoleo*. No *Leporillus* has been recorded in the fauna of Tasmania.

Three species are contained in the genus and all are South Australian.

FIGURE 217.—The characters of the cheek teeth of the genus *Leporillus*, illustrated by *L. jonesi*. A. Crown pattern of left upper molars; B. root sockets of left upper molars; C. crown pattern of left lower molars; D. root sockets of left lower molars.

KEY TO THE SPECIES.

(A.) Tail without white hairs at the tip. Ventral surface of the body drab grey.

(B.) Ears long, well exceeding the length from rhinarium to back of eye. (1) *L. conditor.*

(B¹.) Ears short, slightly less than the length from rhinarium to back of eye. (2) *L. jonesi.*

(A¹.) Tail with white hairs at the tip. Ventral surface of the body white. (3) *L. apicalis.*

(1) House-building Rat.

LEPORILLUS CONDITOR (Gould, 1849).

The House-building Rat has been known from its "wurlies" far longer than it has been known as a zoological type. Major Mitchell in 1838 and Sturt in 1844, noted the large stick nests and described them; but it is only recently that the rat itself has been re-examined.

Between 1849 and 1922 few specimens seem to have been recorded, and it is only within the past two years that sufficient material has been obtained to enable the animal to be studied satisfactorily. In 1923 the species was redescribed by Troughton, who has monographed the genus.

Leporillus conditor is a large, fluffy, long-eared rat, with large eyes and a rather blunt nose. (*See* Figure 218.) Its appearance is very different from that of an ordinary rat, and it is an attractive looking animal. The coat is soft and fine and stands more or less erect so as to give the animal a fluffy appearance. The general body colour is rather a warm light yellowish brown, grizzled with dark brown tipped hairs. Upon the sides the colour becomes more grey and the ventral surface

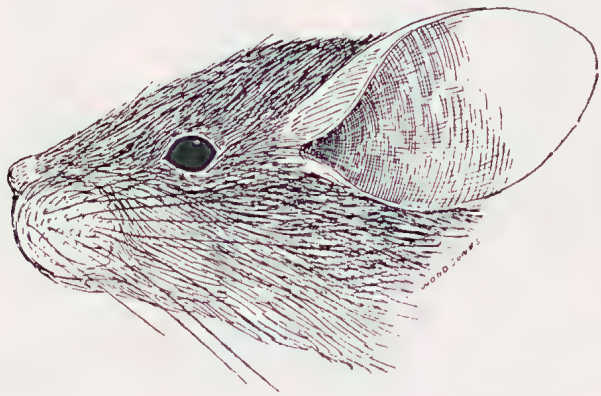

FIGURE 218.—*Leporillus conditor.* The characters of the head of an adult male. Three-quarters natural size.

and inner surface of the limbs is buff grey. The individual hairs on the ventral surface are grey at the base and buff white at the tips. Manus with a dark brown patch on the back. Pes with only a slight dark line running along its outer margin; the remainder of the dorsum being buffy white. Tail evenly haired, and not tufted; dark brown above, light buffy brown beneath in the whole of its length. Ears long and carried erect in the living animal. Nipples four in number and abdomino-inguinal in position.

DIMENSIONS.

	♂	♂	♂	♀	♂	♀
Head and body	215	215	205	205	190	170
Rhinarium to eye	24	25	22	25	21	20
Rhinarium to ear	48	43	39	46	38	40
Ear	38	34	34	38	33	34
Fore foot	16	16	16	16	15	15
Hind foot	42	40	43	43	40	41
Tail	170	145	170	170	152	150

The skull is comparatively lightly built; the muzzle rather long and narrow. (*See* Figure 219.) Interorbital region somewhat narrow and without markedly sharp angled edges. The bullae are larger than those of any other member of the genus. The incisor teeth are slender and light.

DIMENSIONS OF SKULL.

	Adult ♂	Adult ♀
Greatest length	43·5	40
Zygomatic breadth	22	20
Nasals, length	16·5	14
Nasals, breadth	5	4·5
Interorbital breadth	6	6
Breadth of brain case	18	18
Palate length	22	20
Bulla	9	9·5
Upper molar series	8·5	8·5

This most interesting rat still lives in South Australia, but its chance of continued existence is not very good in any area near human settlement.

Fortunately the rats can live in, and almost seem to prefer, very poor country which is not likely to be occupied by man for many years to come. Secure in the fortification of their large piled up stick houses, they are

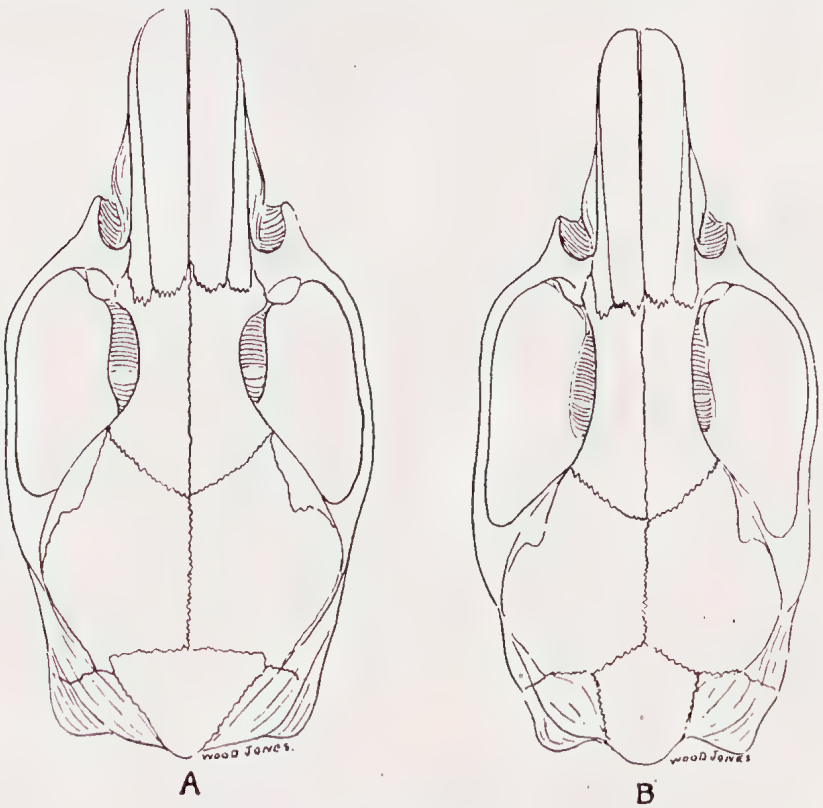

FIGURE 219.—Dorsal aspects of the skulls of (A) *Leporillus jonesi*, and (B) *Leporillus conditor*. Twice natural size.

safe from most natural enemies, and by a curious chance the advancing hordes of rabbits are making their security greater, for just as *Leporillus jonesi* commonly has the burrow of a mutton bird or a penguin beneath its house, so *Leporillus conditor* has usually an emergency exit into a rabbit warren. Human occupation spells extermination to the species by the agencies of trampling cattle and the regrettable folly of setting fire to the pile of sticks which shelters the rats.

These stick nests are very remarkable structures, often more than three feet high, and in the making of them a vast amount of material is employed. Often the nest is constructed round some central object such as a dead bush, and the whole mass of sticks is so securely interlaced that it is a matter of considerable labour to pull one to pieces. Within the nest a small community of rats is established, some half a dozen individuals living in even the smaller nests.

In places from which the rats have been exterminated for some considerable time the remains of these massive nests are still to be seen; and the strange part of it is how the animals ever managed to collect and interlace the great mass of dead wood that has proved so resistant.

Two or three young are produced at a birth, and the time of breeding depends more upon the nature of the season than upon the actual time of year. These young are dragged about by their mother in all her activities, for they cling tightly to the nipples. Even if the mother is chased and captured the young are still found adhering so tightly that it is difficult to dislodge them. These rats make interesting pets in captivity, and they live for several years. They refuse to build houses if they are provided with comfortable beds; but they can never resist the instinct for shifting sticks about.

Those that I have kept would at times start house building, but though much industry was expended on moving the sticks from one place to another and piling them into heaps, no serious attempt was ever made to erect an orderly or permanent dwelling. They preferred to live in their nest boxes and to pile up sticks only as a recreation.

Although this rat was at one time widely distributed in South Australia it has disappeared from all the southern portion of the State. It still lives upon the Nullarbor Plains, and most of the specimens that have been taken in recent years are due to the activities of Mr. A. G. Bolam, of Ooldea. In the country between the East-West and North-South railways there are many places where the wurlies are still to be seen, but, unfortunately, in the greater part of the cattle country the rat itself no longer exists.

(2) Franklin Island House-building Rat.

LEPORILLUS JONESI (Thomas, 1921).

This very fine *Leporillus* is apparently confined to Franklin Island, in the Great Australian Bight. When alive it presents the appearance of a fluffy, sturdy, compact animal, and in general is more reminiscent of a little rabbit when seen squatting, rather than of a typical rat. (*See* Figure 220.) The fur is not very thick, and as seen in a prepared skin or in a spirit specimen it even appears somewhat thin, but during life the animal looks extremely well furred, for the hair is far more erect than in typical rats, and the coat in consequence seems more fluffy.

The hairs of the back average about 17 mm. in length and they are slate coloured at their bases both on the dorsal and ventral surface. General colour above dull brown (not far from "Saccado's umber"). The ventral surface, slaty-grey broadly washed with drabby-whitish, the sides of the belly more strongly drabby. Manus with dark brown patch on the back,

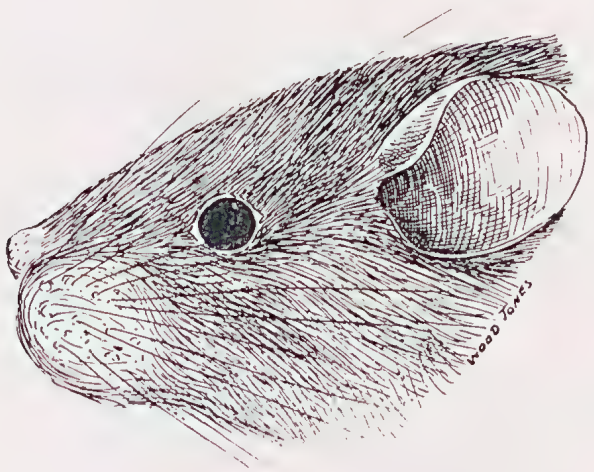

FIGURE 220.—*Leporillus jonesi*. The characters of the head of an adult female. Natural size.

the digits themselves being lighter. (*See* Figure 221.) Pes with ankle, and outer side of dorsum of foot and bases of the digits brown; the inner part of the dorsum of the foot and the tips of the digits white. The tail is well haired, but not tufted; dark brown above, dull whitish below, in the whole of its length.

Ears relatively short and rounded and carried well away from the head. The nipples are four in number and abdomino-inguinal in position.

DIMENSIONS.

	♂	♂	♀	♀	♀	♀
Head and body	210	240	235	235	198	230
Rhinarium to eye	21	25	26	26	21	26
Rhinarium to ear	40	48	42	50	43	51
Ear	28	28	27	30	26	27
Fore foot	19	19	20	18	19	19
Hind foot	45	48	47	44	44	45
Tail	148	162	162	173	145	155

The skull is large and stout, the muzzle broad and heavy. (*See* Figure 222.) Interorbital region broad with comparatively sharp angled edges. The incisor teeth are somewhat slender for so massive a skull; the molars are as shown in Figure 217.

DIMENSIONS OF SKULL.

	Type.	♂	♂	♂
Greatest length	48	46	45·4	44
Zygomatic breadth	23·5	—	23·2	21
Nasals, length	18	16	16·7	16
Nasals, breadth	6	5	5	5
Interorbital breadth	5·7	5	5·5	5·5
Breadth of brain case	18·5	19·5	17·8	17
Zygomatic plate	6	6	—	6·5
Palate length	13·6	21	22	20
Palatal foramina	8·8 x 3·8	8·5 x 3·8	8 x 3·8	8 x 3·8
Bulla	7·8	8·8	8·5	8
Upper molar series	9·3	8·5	10·5	9

These fine rats are abundant on Franklin Island, and were first taken by the writer in 1920 and named by Mr. Oldfield Thomas from the original specimens captured. The existence of the rat on this island had been

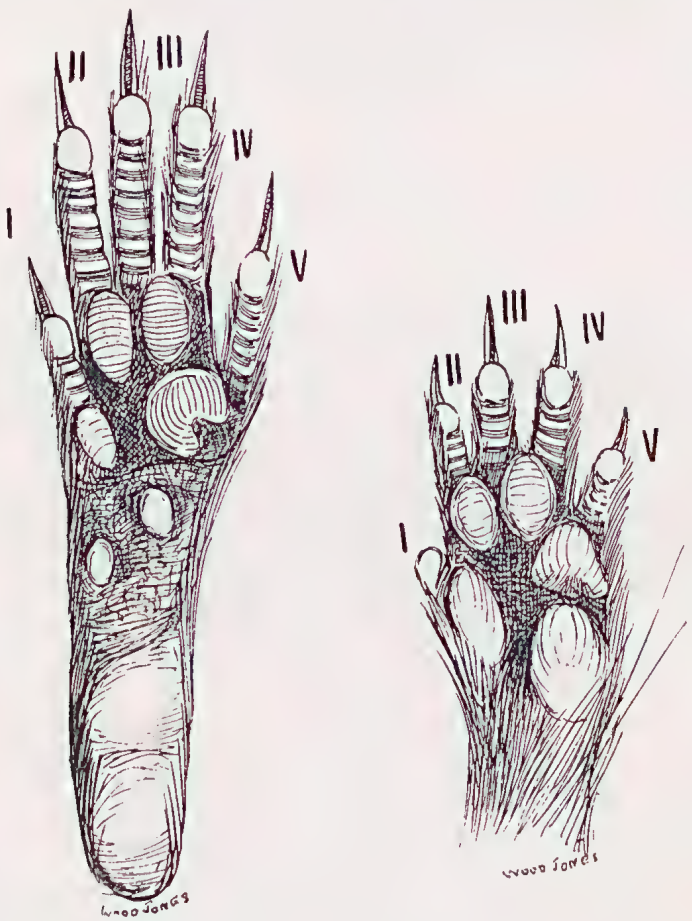

FIGURE 221.—*Leporillus jonesi*. Left pes and manus. Twice natural size.

known for many years, and the animal was always thought to be a marsupial by those who had visited the place This belief arose from the strange habit which rats of this family (and to a lesser degree some other rats) have of carrying the young about with them, the young being

suspended from the nipples, which are grasped firmly in their mouths. There is little to choose between *Leporillus jonesi* and the pouchless marsupial *Dasycercus cristicauda* in their methods of nursing and transporting their young, but this is no excuse for the speculations which have marred the pages of Australian Mammalogy. It is not unnatural that a sailor picking up an animal, from the ventral surface of which the pink and hairless young were suspended, should, in the home of the marsupials, report his find as a marsupial. But this is a different matter from a zoologist suggesting that such an animal may "originally have been a Marsupial Rodent, which is even now in a transition stage between the Metatherian and Eutherian types."

The rat is a nest builder, and, in its island home, the nests are quite conspicuous objects. In some nests an enormous amount of material is collected, and it is often a great puzzle how the rats could have shifted the

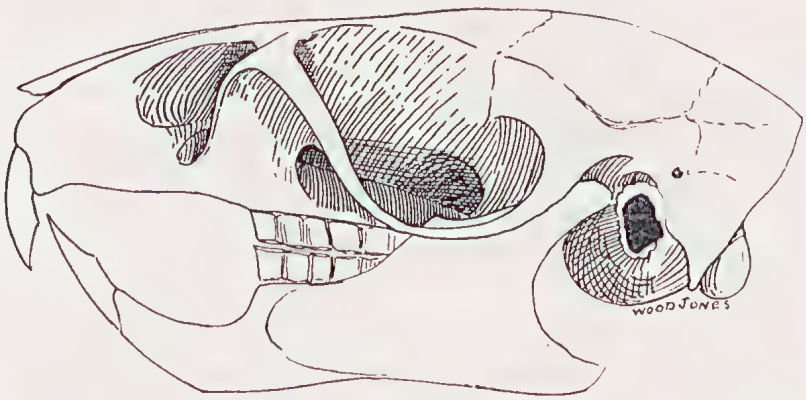

FIGURE 222.—*Leporillus jonesi*. Lateral view of the skull of an adult female. Twice natural size.

large branches and pieces of wood entering into their construction. In the case of one very large nest I think there was no doubt that a deserted sea eagle's nest had been added to and improved upon and in many others the nest was made around a dead bush or a piled up mass of dead branches. These large nests are complicated structures, and they are tunnelled by a series of galleries, the design of which is difficult to follow. In these large nests quite a community of rats take up their abode. Smaller nests containing only a central chamber and an entrance and exit run, as a rule, only lodge a single pair. Upon the flat top of the island the nests are usually made of dried twigs, but upon the shore platform the rats mostly pile up fresh pieces of the Pig Face (*Mesembryanthemum*), and, nearer to the sea, dried seaweed and wrack are employed. Down on the beach a wisp of wrack tucked in between two boulders, or some seaweed collected in a cleft in the granite rocks, suffices for a home. In any case the nests smell badly, the lining is stained yellow and reeks of ammonia; and all the nests examined harboured numbers of a beetle (*Ectroma benefica*. Newm.).

There is a peculiar feature about the larger nests which are built upon the flats, for most of them are undermined by burrows of penguins (*Eudyptula minor*) or mutton birds (*Puffinus tenuirostris*). It is a remarkable fact that on this island the mutton birds, penguins, rats, bandicoots (*Isoodon nauticus*), and black tiger snakes will all bolt into the same hole when alarmed; and the presence of the tiger snakes makes the exploration of the holes a matter for some consideration. The rats make no burrows of their own. In captivity no desire to burrow or even to scratch into the earth is evinced; but in captivity, if the bed provided is sufficiently to their liking, they will, as a rule, not construct a house, though the instinct to carry and pile up sticks is always with them.

Quite a large proportion of the rat population of Franklin Island lives upon the sea beaches, beneath and between the great granite boulders which lie scattered along the shore. The staple article of diet is the succulent leaves of *Tetragona implexicoma,* and enormous quantities are consumed, the alimentary canal of the animal being extremely bulky. In captivity they will eat, and do well on, such things as suit an ordinary rat; but strangely enough no bait seems to especially attract them, and they are, therefore, difficult to take in traps. The rats are great frequenters of the sea shore and their footprints are always to be found right down to low water mark. They are independent of fresh water. The breeding season is in the colder months of the year.

These rats live well in captivity, and are extremely gentle and tame. They are long-lived for rats, for specimens taken when fully adult have lived several years in captivity. They do not bite when handled, and as pets are far more attractive than most of the murines.

It is much to be hoped that this interesting and entirely harmless rat will long be permitted to remain in peace on its island home, a sanctuary that should remain inviolate, not only on account of the *Leporillus,* but because it is also the last stronghold of the South Australian Short-nosed Bandicoots.

(3) White-tipped House-building Rat.

LEPORILLUS APICALIS (Gould, 1851).

The description of this species is taken from previously published accounts. I know of no recent capture of the animal in South Australia and no material is available for study. The rat is small and more lightly built than the other members of the genus. General body colour light brown, scarcely grizzled by the admixture of dark hairs. Ventral surface white, the individual hairs having no smoky basal colour. Manus white, with a small dark band separating the white from the general light brown of the fore limb. Pes white, with a light brown mark on the outer side. Tail brown on the dorsal surface above at the base, the tip being clothed with longer white hairs; beneath, the tail is entirely

white; scales average nine to the centimetre. Ears long, longer than the length from the nose to the back of the eye. Nipples four in number and abdomino-inguinal in position.

DIMENSIONS.

	Waite.
Head and body	169·0
Rhinarium to ear	38·5
Ear	31
Hind foot	40·8
Tail	236

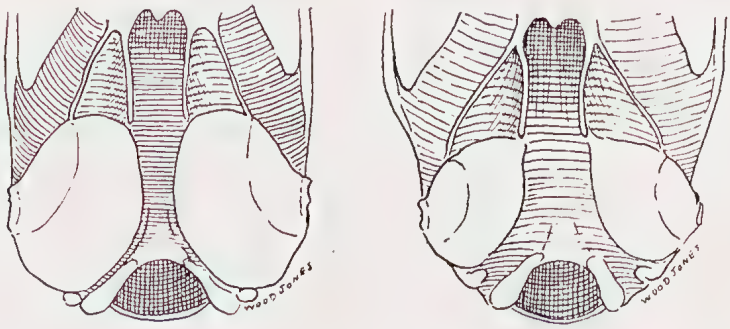

FIGURE 223.—Hind end of the base of the skull of (A) *Leporillus conditor*, and (B) *L. apicalis*, to show the difference in architecture, especially in the size of the bullae. Twice natural size.

The skull is lightly built and elongated. Interorbital region broad with sharp angled edges. The bullae are small when compared with those of *L. conditor*. (*See* Figure 223.) Incisor teeth light and teeth all smaller than in the other two members of the genus.

DIMENSIONS OF SKULL.

	Waite.
Greatest length	41·4
Zygomatic breadth	20·7
Nasals, length	14·6
Nasals, breadth	4·7
Interorbital breadth	5·2
Breadth of brain case	16·9
Palate length	21·4
Bulla	7·5
Upper molar series	7·4

Very little is known concerning this rat. Gould's specimens were obtained in South Australia. Krefft procured them from the plains of the Murray and the Darling. More recently they were captured in Central Australia. Evidently in Krefft's time they were abundant, and he speaks of them "coming about the camp, mounting the supper table at tea time for their share of sugar and damper." According to the same authority these rats lived in nests like the other members of the genus, but they

also inhabited hollow trees, a habit doubtless due to their living in well timbered country. It is much to be hoped that this rat may be found again, and as two specimens were procured at Alice Springs by Gillen and recorded by Waite in 1897, it is possible that it still has a stronghold in the North.

Genus 7.—CONILURUS (Ogilby, 1838).

The skull of members of this genus is highly modified and is broad and flattened. The interorbital region is concave. The pes is normal and possesses the typical six pads. In general appearance they are not unlike the members of the genus *Leporillus*. Of the two species included in the genus one inhabited South Australia.

White-footed Rabbit-rat.

Conilurus albipes (Lichtenstein, 1827).

This fine rat, which formerly had a wide range, but was nowhere very plentiful, seems to have disappeared completely from South Australia. The size is large, the head and body attaining a length of some ten inches. The description is taken from Gould's account. Fur long, soft, and close. The head, ears, dorsal surface and flanks, as well as the outer surface of the limbs, grey at the base and ashy brown at the tips. Numerous fine black hairs are intermixed with the brown hairs of the dorsal surface. The facial vibrissae and a narrow line around the eye (not shown in Gould's figure) are black. The ventral surface of the body, the inner aspect of the limbs, the manus and the upper surface of the pes are white. The tail about the same length as the head and body, or but little shorter, dark brown on the dorsal surface, white on the sides and ventral surface.

According to Gould this species ranged through New South Wales and Victoria into South Australia. It was nowhere very plentiful and preferred well timbered and fertile spots. It lived in hollow logs and in the hollow trunks of standing trees, where it made a comfortable, well lined, nest in which it slept during the day and only came abroad at night. There is no recent information concerning its presence in South Australia.

Genus 8.—ZYZOMYS (Thomas, 1909).

The genus contains but a single species, of which one sub-species is described. The size is small, the form delicate. The tail is lightly pencilled terminally. The skull is light and delicate and not bowed in front.

White-tailed Rat.

Zyzomys argurus (Thomas, 1889).

Of this very distinct species there is no material available in South Australia, which was the home of the type specimen. The description is taken from the original account by Oldfield Thomas.

Size small, almost equal to that of a small example of *Pseudomys* (*Thetomys*) *nanus*. Fur crisp and even slightly spinous. General colour

on the dorsal surface pale sandy rufous, the hairs slate colour at their bases. Ears rounded, very thinly covered with fine white hairs; when laid forwards they reach just beyond the middle of the eye. The muzzle and ventral surface of the body white, the line of demarkation on the sides not sharply marked. Hairs of ventral surface pale rufous at their bases. Manus and pes pure white. The pes with six sole pads, the posterior one elongated. Tail rather longer than the head and body, more thickly covered with hair than is usual; the hairs pure white. Scales thirteen or fourteen to the centimetre, pale flesh coloured. The tip of the tail is slightly pencilled.

DIMENSIONS.

Head and body	83
Ear	14
Pes	22
Tail	101

The skull is smooth and unridged.

DIMENSIONS OF SKULL.

Basal length	24·6
Zygomatic breadth	14
Interorbital constriction	4·8
Nasals, length	11·2
Palate length	16
Upper molar series	5·5

There seem to be no recent records of this remarkable little rat, and no observations on its habits. Probably it is one of the many lost species of which no specimens are preserved in our State collections.

Genus 9.—NOTOMYS (Lesson, 1841).

This genus contains the long-legged jumping mice often known as Jerboa Mice. The hind feet are elongated and the pads are reduced from the typical six to four. The tail is long and more or less tufted, and the ears

Figure 224.—The characters of the cheek teeth of the Genus *Notomys*, illustrated by *N. mitchelli*. A. Crown pattern of left upper molars; B. sockets for roots of left upper molars; C. crown pattern of left lower molars; D. sockets for roots of left lower molars.

are large and rounded. For details of dentition *see* Figure 224. Two species inhabit this State.

(1) Long-tailed Jerboa Mouse.

NOTOMYS LONGICAUDATUS (Gould, 1844).

In addition to Gould's original description of this fine Jerboa Mouse, there is fortunately the more recently collected material of the Horn Expedition, from which Waite has made a satisfactory series of measurements, and collected a number of details of description. In the volume of the Horn Expedition itself the animal is confused by Sir Baldwin Spencer with Mitchell's Jerboa Mouse.

The animal is a comparatively large one, and the length of the tail considerably exceeds that of the head and body. The fur is close and very soft. General colour above pale sandy, with numerous fine black hairs intermixed. These fine black hairs are longest at the hind end of the body. Ventral surface white. Manus and pes white. The ears are large, naked,

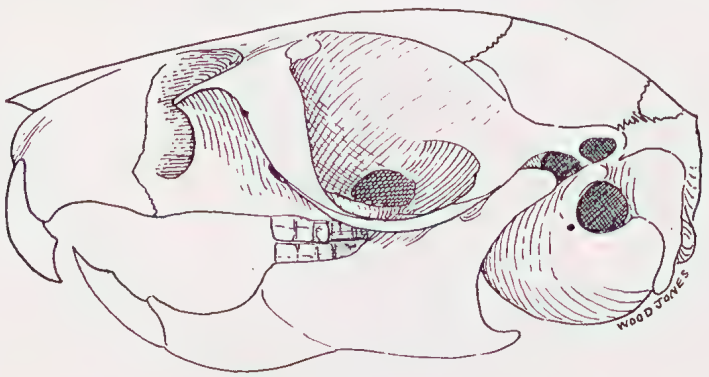

FIGURE 225.—Lateral view of the skull of an adult male *Notomys longicaudatus*. Twice natural size.

and dark brown in colour. The tail long, basal portion clothed with short dark brown hairs, the apical half with longer black hairs tipped with white. According to Gould the extreme tip of the tail is white, but Waite noted that, in his specimens, the white hairs when present appear to be developed chiefly on the lower surface and are not so numerous as to produce an actual white tip. The scales on the tail average twelve to the centimetre. The pes is highly modified. The three middle digits are set in advance of the marginal digits and the sole is long and narrow. Four pads are present.

DIMENSIONS.

Measurements by Waite.

	♂	♂	♂	♀	♀
Head and body	131	125·2	118	124	119
Rhinarium to ear	36·4	36·1	35·6	35	31·6
Ear	26·4	24·5	26·8	24	21·9
Pes	44·1	42·9	43	42	42
Tail	192	187	157	192	156

The skull is massively built, the brain case rounded. Anterior root of the zygoma very large, its anterior margin deeply concave. The bullae are large. Upper incisors stout, strongly curved, orange in colour. (*See* Figure 225.)

DIMENSIONS OF SKULL.

Measurements by Waite.

	♂	♀
Greatest length	39·9	35·2
Basal length	33·2	28·3
Zygomatic breadth	21·8	19
Interorbital constriction	6·3	6·4
Nasals, length	14·9	13·2
Palate length	20·6	17·3
Upper molar series	6·8	6·3

The specimens obtained by the Horn Expedition were from Burt Plains, north of Alice Springs. But at one time its range extended further south.

(2) Mitchell's Jerboa Mouse.

NOTOMYS MITCHELLI (Ogilby, 1838).

This, the first known species of jumping mouse, is smaller than *N. longicaudatus* and larger than *Ascopharynx cervinus* or *A. fuscus*.

In colour it is extremely like *A. fuscus*, but is readily distinguished from that species by the absence of a gular pouch. The type specimens of the species are preserved in the Australian Museum in Sydney, and Mr. Troughton has re-examined these specimens in order to determine their characters more precisely than they were given in former accounts. There can now be little doubt that the animal with which we are familiar in this State is the same animal as that which Major Mitchell captured, and, moreover, it is still living in the scrublands of the Murray, where he originally obtained it. In 1922, when Oldfield Thomas was writing of the genus *Notomys*, he said of *N. mitchelli*:—"Whether the species is now completely exterminated we do not know." It is pleasing that, in this instance, we can place on record the fact of an animal, the existence of which was in some doubt, is still living, and, moreover, still occupies its old haunts.

In general form *N. mitchelli* resembles the other Jerboa Mice (*see* Figure 226), and by casual observation is indistinguishable from *Ascopharynx fuscus*. The general colour of the whole dorsal surface is a grizzled isabelline brown. The individual hairs are dark smoky at the base, brown over the greater portion of the shaft, and darker at the tips. The dark tipped hairs become more numerous and the dark tips longer over the hind end of the body. The hairs of the mid dorsal region measure 13 mm. On the whole, the general coat colour is a more contrasted grizzle than is present in *A. fuscus*, the species with which it is most likely to be

confused. The sides of the face are lighter, the cheeks being greyish white. The sides of the body and the outer surface of the limbs are of a brighter tint of brown and the dark tipped hairs are lacking. The colour of the dorsal surface and the sides of the body changes rather abruptly to the pure white of the ventral surface. The individual hairs of the ventral surface are dark smoky at the base and for about half the length of the shaft, the tips being pure white. Manus and pes almost pure white. Ears large, naked, and membranous in texture; clothed at the immediate base with the general hair of the head; the naked portion, which is coloured

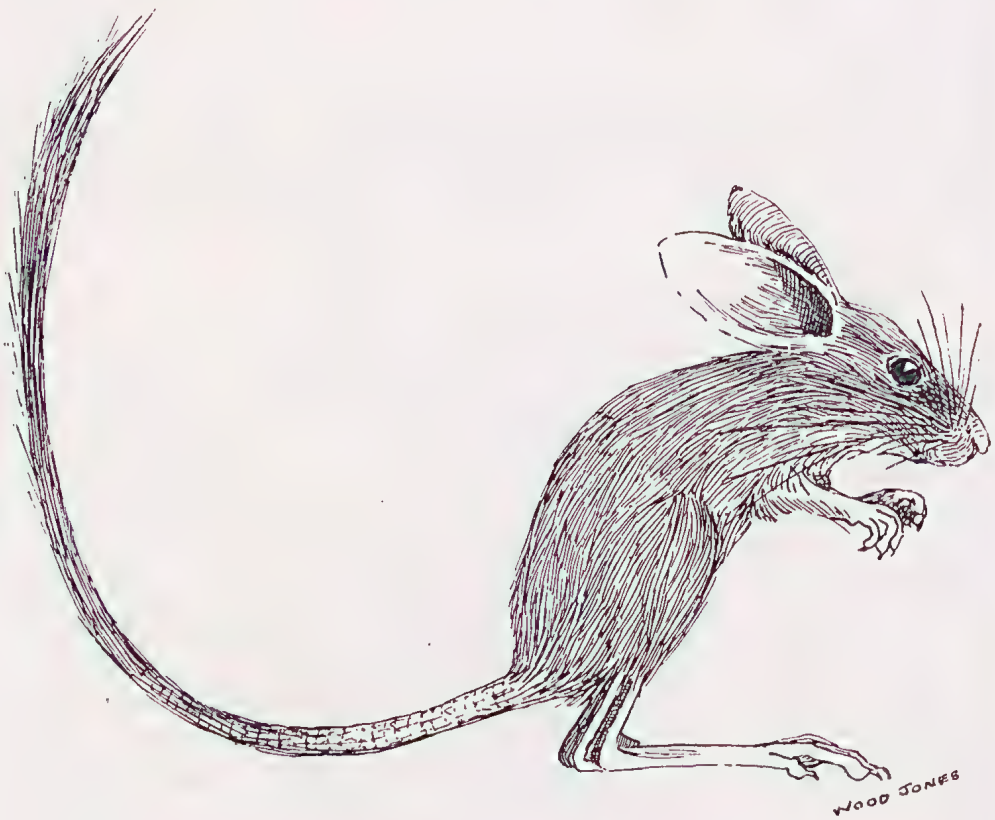

FIGURE 226.—A typical Jerboa mouse, *Ascopharynx cervinus*. Four-fifths natural size.

dusky brown, being sparsely clothed with minute hairs of a darker shade of brown than the general body colour. The rhinarium, as well as the palms and soles, pink flesh coloured. Vibrissae long and dark, the longest measuring upwards of 60 mm.

Sole of pes elongated and narrow. Four pads are present, one small pad being situated at the base of digit I., two large pads at the bases of digits II., III., and IV., and another small pad at the base of digit V. The tail is longer than the head and body. It is clothed above with brown hairs, short at the base, but forming a well marked terminal pencil; below the hairs are white, the terminal brush being brown above and white below. The scales vary from 11 to 15 to the centimetre.

In size the species is rather variable, and animals bred in captivity in Adelaide have grown considerably larger than their parents which came from the arid Nullarbor Plains.

DIMENSIONS.

Series of specimens captured at Ooldea.

	♂	♂	♀	♀	♀
Head and body	123	119	125	120	118
Rhinarium to ear	32	31	32	30	32
Ear	26	25	25	23	25·5
Pes	37·5	37	35	34·5	35
Tail	155	153	140	120*	140

* Tail imperfect.

Specimen bred in captivity.

	♀
Head and body	132
Rhinarium to ear	32
Ear	26
Pes	39
Tail	150

A specimen from the mallee country twelve miles from Murray Bridge, though not exceeding the Ooldea examples in size, has relatively larger feet and probably represents the sub-species *N. mitchelli macropus* (Thomas, 1921), the type of which came from South Australia.

DIMENSIONS.

	♂
Head and body	117
Rhinarium to ear	30·5
Ear	25
Pes	39
Tail	139

The skull is considerably smaller than that of *N. longicaudatus*. The palatine foramen extends backwards just beyond the anterior margin of the first cheek tooth. The inner pterygoid processes are slightly curved outwards at their posterior extremities.

DIMENSIONS OF SKULL.

	Typical ♂ Ooldea.	♀ Reared in captivity.	♂ *macropus*, Murray Bridge.
Greatest length	31	34·5	32·5
Basal length	27	30	30
Zygomatic breadth	16	17·5	17
Interorbital constriction	5	6	5
Nasals, length	10·5	13	11·5
Palate length	15·5	17	17
Upper molar series	5	5	5·5

This jumping mouse is by no means uncommon about Ooldea, where it lives in company with *A. fuscus,* and although I have, so far, only obtained one specimen from the mallee country of the Murray, I have had reports of the existence of a Jerboa mouse from several districts in the Southern portion of the State. By the Horn Expedition it was erroneously reported from the country north of Alice Springs, but apparently its range does not extend so far North as does that of *N. longicaudatus* and *Ascopharynx cervinus* and *A. fuscus.*

The animal thrives well in captivity, and is a beautiful and gentle little creature, which, like *A. cervinus* and *A. fuscus,* has a long life span for a murine, since it certainly exceeds three years. Although no animals have actually bred in captivity, naked young captured with the mother have been easily reared and have become exceedingly tame. These young animals, two of which constitute the usual litter, are those which have grown so considerably larger than their wild-caught kindred. This phenomenon of animals from the arid Centre growing larger when bred and reared in captivity is not an isolated one, or one confined to the genus *Notomys,* for the marsupial *Dasycercus cristicauda* (*see* page 103), of which I have bred three generations from wild-caught stock, shows a marked increase in size under domestication.

Genus 10.—ASCOPHARYNX (Waite, 1900).

In general characters the members of this genus resemble those belonging to *Notomys;* but they differ from them in the possession of a gular pouch. This gular pouch consists of a little skin pocket lined by thick hairs, which

Figure 227.—Underside of the neck of *Ascopharynx fuscus* to show the gular pouch. Twice natural size.

is situated on the ventral surface of the neck. The opening of this pouch is directed forwards, and it is extremely like that which is present in many species of Bats. (*See* Figure 227 and compare with Figure 256.) The pouch is present in both sexes, and it is probably glandular, but its true function is quite unknown. Two species are contained in the genus and both occur in South Australia.

(1) Fawn-coloured Jerboa Mouse.

ASCOPHARYNX CERVINUS (Gould, 1851).

This beautiful little jumping mouse is distinguished by the possession of a gular pouch, the presence of entirely white hairs on the ventral surface of the body, and a pad at the base of the hallux. The general form is light and delicate; the hind limbs and pes greatly elongated, the ears large and semi-transparent. The general colour of the dorsal surface of head and body is a beautiful pale fawn. The individual hairs are smoky at the base, light fawn coloured in the greater portion of their length, and variably tipped with brown.

At the sides of the body the hairs are white with smoky bases, but on the ventral surface the hairs are pure white in the whole of their length. The brown-tipped hairs are more numerous, and the brown tips are longer, towards the hind end of the body. The muzzle is paler than the general colour of the dorsal surface, the face being yellowish white. The rhinarium is pink and is very characteristically bent downwards at the tip. The species might almost be described as having a hooked nose. The eyes are large and black. Facial vibrissae long, the longest measuring 53 mm., and all, except the short anterior members of the series, are dark in colour. The ears are extremely long, thin, almost membranous in texture, and coloured flesh pink in the living animal. The base of the ear is clothed with pale fawn coloured hair without, but the remainder of its surface is naked save for a few pale down hairs. Manus and pes pure white. Palms and soles flesh pink. The pads of the sole are four in number. (*See* Figure 228.) A small pad is situated at the bases of digit I., two large pads at the bases of digits II., III., and IV., and another small pad at the base of digit V. The pes is narrow, its maximum breadth being 4.5 mm. The tail is long, considerably exceeding the length of head and body. It is clothed with fine hairs, which, at the base, are about the length of three scale rows, but towards the tip are elongated so that the tip of the tail is definitely tufted. The tail is uniformly isabelline fawn coloured save for the terminal, pencilled, portion which is dark above and pale below. The scale rows average twelve to the centimetre. The gular pouch is present in both sexes. It is situated at the base of the neck and contains a mass of white hairs which grow as a thick lining to the apparently glandular sac.

DIMENSIONS.

Specimens from Killalpaninna.

	♂	♀	♀
Head and body	108	110	96
Rhinarium to ear	27	28	26·5
Ear	24	25	23
Pes	35	33	33·5
Tail	156	130	120

These measurements are in perfect harmony with those given by Waite for a series of specimens from Alice Springs and Charlotte Waters.

The skull is lightly built and delicate. The zygoma is flattened and broadened at its anterior end, but exceedingly thin posteriorly.

DIMENSIONS OF SKULL.

	Wilgena. ♀	Killalpaninna. ♂
Greatest length	31	29·5
Basal length	28	26
Zygomatic breadth	16	15
Interorbital constriction	5·5	5·5
Nasals, length	10	10
Palate length	16	14
Upper molar series	5	5

This beautiful little jumping mouse is a typical desert animal in colouration and in habit. Its range in this State is a wide one in the more arid parts, and I have obtained specimens at Killalpaninna, on Cooper's Creek, at Miller's Creek, and at Wilgena.

In captivity it is extremely gentle and makes a very beautiful pet, its activity being astonishing. It is a very remarkable thing to see this animal as dusk comes on, for although it is content to spend its time during daylight curled up in its nest, when evening sets in it becomes transformed. It will stand erect on its hind legs beneath a bench three feet from the ground and next moment, and seemingly without effort, it is sitting on the bench cleaning its whiskers with its delicate hands. It has also a remarkable aptitude for jumping sideways, a character which it shares with its desert companion the Barred Bandicoot. These pretty little mice thrive well in captivity, but I have not succeeded in getting them to breed, even after permitting them the unfettered run of a large room. They are long lived animals, for their span of life certainly exceeds three years. Observations on captive specimens have failed to provide any clue as to the true functions of the gular pouch.

(2) Dusky Jerboa Mouse.

ASCOPHARYNX FUSCUS (Wood Jones, 1925).

This little jumping mouse, which is readily distinguished from its allies by its external characters, has previously been confused with the other Jerboa mice in whose company it happens to be living in any of the districts of the more arid parts of the Centre.

In describing *A. cervinus*, Gould mentions that a darker form is sometimes met with, and he figures, in a rather unconvincing manner, this darker form in the background of his plate depicting the Fawn-coloured Jerboa Mouse. Waite, when examining the specimens of Jerboa mice procured by the Horn Expedition, noticed that among the specimens obtained from

Charlotte Waters and Alice Springs there were some specimens, which, though possessing a gular pouch, differed from *A. cervinus* in being of a darker colour.

Of this type he says—"A darker form was considered to be a second species of the genus (*Ascopharynx*) until a comparative examination of the skulls showed it to be specifically identical. The fawn-coloured portions are replaced by a much deeper tint and the fur of the under parts is grey at the base." He also notes that "In colour it resembles *N. mitchelli.*" In noting the difference in the colour of the base of the ventral white hairs,

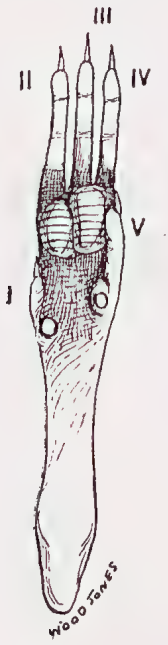

FIGURE 228.—*Ascopharynx cervinus.* Plantar surface of left pes. Twice natural size. Note the pad at base of the first digit.

FIGURE 229.—*Ascopharynx fuscus.* Plantar surface of left pes. Twice natural size. Note the absence of a pad at the base of the first digit.

Waite recognised one of the specific characters of *A. fuscus.* It was owing to the researches of Waite that the murines with specialized feet and reduced pads were separated from the old genus *Conilurus,* which contained murines with normal feet as well as those having specialized feet. In making this separation Waite noted that of the six pads present in normal murines "two or more are absent" in the Jerboa mice. As we have seen, two are absent in all the forms previously described; the only member, which has been adequately described up to the present time, having more than two absent is *A. fuscus.* The fact that the so-called "dark form" of *A. cervinus* has a different type of sole pads, as well as a different character of coat colouration, gives it the right to specific rank; and the animal has accordingly been named *Ascopharynx fuscus.* It may be said at once that, in all, some nine species of Jerboa Mice of the genera *Notomys* and *Ascopharynx* have been described, but the descriptions of most of these

species are so insufficient that it is impossible to determine if the present form has been previously named by authors who have neglected details of structure necessary for the proper determination of species of this genus.

This species, which resembles *A. cervinus* in possessing a gular pouch in both sexes, differs from that species in general colouration and in the colour of the individual hairs, as well as in the fact that the foot, which is considerably broader, has no pad at the base of the first digit.

The general colour of the head and dorsal surface of the body is light isabelline brown, lacking altogether that yellowness which renders *A. cervinus* fawn coloured. Not only is the shade of yellow absent, but the whole colouration is considerably darker and more drab. In general form it resembles *A. cervinus* very closely, and its measurements do not differ in any constant direction from those of that species.

The individual hairs of the dorsal surface are smoky at the base, brown in the greater portion of their length, the tips being only slightly darker than the shafts. The contrast between the colour of the shaft and the tip of the hairs of the dorsal surface is not so marked as in *A. cervinus*, the whole pelage being more uniform dull brown and not so definitely flecked with dark tipped hairs at the hinder end of the body. At the sides of the body the darker tips of the hairs disappear altogether, and the brown of the dorsal surface merges somewhat gradually into the white of the ventral surface. The face is uniformly coloured the same light brown as characterizes the head and dorsal surface. The outer surface of the limbs rather brighter brown than the dorsal surface. Inner surface of the limbs and the whole of the ventral surface white, but, in distinction from *A. cervinus*, the white hairs of the ventral surface are pale smoky at their bases and not pure white in the whole of their extent as they are in that species. The rhinarium is dusky pink and is not so prominent or hooked as it is in *A. cervinus*. The vibrissae are long and, save for a few of the short anterior members, which are white throughout, are dark brown at the base and white at the tips; the longest measures 52 mm. The ears are long, thin, and membranous, but are dusky in colour throughout, a few light brown hairs clothing the base without and being sparsely scattered over the surface of the auricle. Manus and pes white, but the soles more dusky in colour than those of *A. cervinus*.

The pes is more robust that that of *A. cervinus*, its breadth across the base of the three middle digits averaging 6 mm. instead of 4.5 mm. as in the latter species. The pads of the sole are constantly reduced to three, the pad at the base of digit I. being quite unrepresented. (*See* Figure 229.) The tail is long, considerably exceeding the length of the head and body. It is clothed with short brown hairs on its dorsal surface and well pencilled at the end with a tuft of brown hairs; below the hairs are white, a small portion of the ventral surface of the terminal pencil being composed of

white hairs. The scale rows average fourteen to the centimetre. The gular pouch is present in both sexes and differs in no way from that of *A. cervinus*. The nipples are four in number and abdomino-inguinal in position.

DIMENSIONS.

Specimens from Ooldea.

	♂	♂	♀	♀
Head and body	110	103	110	105
Rhinarium to ear	31	28	29	28
Ear	27	25	—	25
Pes	34	32·5	33	32·5
Tail	125	85*	135	108*

* The tails of these specimens imperfect.

The skull differs from that of *A. cervinus* in possessing palatal formanina which extend backwards past the anterior edge of the first molar tooth and in the form of the mesial pterygoid processes, which are curved outwards at their posterior extremities, instead of being practically straight.

DIMENSIONS OF SKULL.

Adult from Ooldea.

	♀
Greatest length	30
Basal length	27
Zygomatic breadth	16
Interorbital constriction	5·5
Nasals, length	10
Palate length	15
Upper molar series	5

This Jerboa Mouse is not uncommon about Ooldea, whence I have received numerous specimens from Mr. A. G. Bolam. Although at Charlotte Waters and Alice Springs it was found living in company with *A. cervinus*, with which species it has, as we have seen, been previously confused, at Ooldea it lives in company with *Notomys mitchelli*, and there is confounded with that species. I have had all three species living in harmony together. Although in general colouration *A. fuscus* differs from *A. cervinus* very markedly, it resembles *N. mitchelli* so closely that by casual observation it is impossible to separate the one species from the other. All three species will share one nesting box, and in habits they are identical. It is a remarkable thing that in a mixed company of *A. fuscus* and *N. mitchelli*, such as I have had for several years, no difference of habit can be detected between the species possessing the gular pouch and the species in which it is lacking. The species of Jerboa Mice furnish a good example of the general truth that, when dealing with small mammals, casual observations are useless for determining specific characters. For some years I have

had under observation living examples of the two species (*A. fuscus* and *N. mitchelli*), representing two genera, the one species possessing a gular pouch and no first digital pad, the other lacking a gular pouch but possessing a first digital pad; but only after carefully examining preserved specimens realising their difference. It is easy to see that without extensive collecting, careful preservation, and patient study we shall not attain to any real knowledge of our smaller mammals before the day of their inevitable extermination arrives. In Australia all too little has been done, and although so much remains to do and so little time will be available for its accomplishment, there are as yet few indications that a public spirit or an administrative sympathy are developing to encourage the endeavour.

Order CARNIVORA.

Terrestrial mammals with teeth adapted to flesh eating, and with unguiculate feet.

There are no indigenous members of the Carnivora in Australia, but certain introduced forms are of the utmost importance economically, and one is of considerable zoological interest. These introduced forms are embraced in two Families distinguished as follows:—

(A.) Cheek teeth with definite crushing surfaces: claws not retractile.
Family I. *Canidae.*

(A^1.) Cheek teeth without crushing surfaces: claws retractile.
Family II. *Felidae.*

Family I.—CANIDAE.

The dog-like carnivores have well developed cheek teeth and digitigrade feet. The legs are long and the digits are 5 on the manus and 4 on the pes in some members, but only 4 on both manus and pes in others. The two genera represented by species in Australia may be distinguished as follows:—

(A.) Supraorbital processes of the skull, swollen and convex above. (*See* Figure 230.) Pupil of eye circular.
Genus I. *Canis.*

(A^1.) Supraorbital processes of the skull not swollen: concave above. (*See* Figure 231.) Pupil of the eye elliptical.
Genus II. *Vulpes.*

Genus 1.—CANIS (Linnaeus, 1758).

The genus contains the true wolves, American prairie wolves, Old World jackals—and domestic dogs. The dental formula is I. $\frac{3-3}{3-3}$. C. $\frac{1-1}{1-1}$. P.M. $\frac{4-4}{4-4}$. M. $\frac{2-2}{3-3}$. The last upper premolar and the first lower molar are specialized

as cutting teeth and are known as the *Carnassials*. Australia's interesting representative of the genus *Canis*—the Dingo—is an introduction.

Dingo, Warrigal, Wild Dog.

CANIS FAMILIARIS DINGO (Blumenbach, 1780).

There is little need to give a formal description of an animal so well known as the Dingo. Nevertheless there are certain characters which, though often disregarded, cannot be ignored if we are to come to any just estimate of its position in the Australian fauna. The coat colour varies from black to almost white, the commonest colours being reddish yellow or dark cream yellow. The coat is straight and fairly close, there

FIGURE 230.—*Canis familiaris dingo.* The orbital portion of the skull of a Dingo to show the type of supraorbital processes characteristic of the Genus *Canis*.

being an ample underfur. The individual hairs of the mid line of the back are of an average length of 30 mm. The dorsal surface of the head and mid line of the back are usually darker than the general coat colour. The ventral surface and inner sides of the limbs are paler. The tip of the tail and the manus and pes are light; in yellow dogs being usually white. The ears are large and pointed at the tips; they are carried erect and are amply clothed and fringed with hairs. The tail is clothed in its whole length with hairs some 60 mm. in length, and in the animal as usually seen in the bush is carried at a droop, though in animals reared as pets it is usually carried erect; when alert the tail is bristled into a fine brush. The naked rhinarium varies from black to pink, with brown as its most usual colour. The iris is varying shades of brown; the pupil is truly circular in all degrees of contraction. The manus and pes are large when comparison is made with common dogs of comparable size and build. An

average dingo is some 1500 mm. in head and body length, the tail being about 350 mm. The skull (*see* Figure 232) is that of a typical dog in all respects (save those to be mentioned later), and especial note should be

FIGURE 231.—*Vulpes vulpes.* The orbital portion of the skull of a Fox to show the type of supraorbital processes characteristic of the Genus *Vulpes.* Natural size.

paid to that portion of bone which projects over the socket for the eye. This—the supraorbital process—is somewhat swollen, so as to be convex on its upper surface.

DIMENSIONS OF SKULL.

The ten skulls here measured are taken at random from a series of over twenty.

Basal length	178	178	177	175	174	174	174	173	172	171
Breadth	100	98	96	98	98	100	92	98	96	94
Breadth of brain case .	55	55	55	55	52	53	55	52	52	54
Nasals, length	60	60	58	58	57	60	57	56	57	59
Nasals, breadth	16	16	16	16	15	15	15	15	15	15
Palate length	94	94	94	92	93	95	92	90	92	90
Interorbital constriction	35	36	36	35	34	34	36	33	34	34
Length of row of cheek teeth	67	67	67	66	66	66	67	66	65	65

In order to make an impartial study of the Dingo as a zoological type it is necessary to make some attempt to clear away certain misconceptions which have come to surround the subject. Varying opinions have been formed concerning the origin and nature of the Dingo, and many of these opinions have been stated so authoritatively and copied so freely that they have often been accepted as final, although, as a matter of fact, they rest on nothing more than a mere haphazard statement founded on no proper examination of the characters of the animal. In 1916 Etheridge issued a memoir on this subject, and in it he postulates two alternatives: the Dingo may be indigenous, or it may be introduced; but he concludes his essay by saying, "Which of the postulates the reader is prepared to adopt must be left to his interpretation of the facts stated." The reader will possibly

be left with the impression that the author believes the animal to be indigenous, but the facts embodied in the substance of the paper are hardly sufficient for either author or reader to form a very definite opinion.

This uncertainty is, unfortunately, given currency in text-book literature, and Beddard (Mammalia, Cam. Nat. Hist., p. 421) says, "it does not seem certain whether it was tamed and brought over to Australia by the native races, or is a true and indigenous Australian species."

A brief survey of the literature yields the following opinions expressed, from time to time, by authorities upon Australian zoology:—

(1) The Dingo has been claimed to be an indigenous Australian mammal —an animal which originated within the confines of the Australian continent. Prof. McCoy (Prod. Paleont. Vict., Acc. vii., pp. 7-10) remarks that "the Dingo was really one of the most ancient of the indigenous mammals of the country." Again, Gerald Krefft (Mammals of Australia) says, "It must be accepted as a fact that the Dingo is indigenous."

FIGURE 232.—*Canis familiaris dingo.* Typical skull of a Dingo from Northern South Australia. Half natural size.

(2) It has been claimed that the Dingo is not only an indigenous Australian mammal, but, that it is, actually, the ancestor of the domestic dog. J. Douglas Ogilby (Cat. Aust, Mamm., p. 125) states, "Until proof to the contrary is forthcoming, we shall consider the honour of being the original progenitor of our domestic favourite as due to the Australian Warrigal."

(3) It has been claimed that the Dingo is a wild, true species of *Canis* which came to Australia, unaided by and unassociated with man, by a land route which has ceased to exist. Lucas and Le Souëf (Animals of Australia, pp. 9-14) assert, "We must conclude that the Dingo reached this continent without the aid of man;" he "wandered into Australia when the land bridge existed where Torres Strait is now." The same view is expressed by Dr. R. L. Jack, who says (Geol. Pal. Q'land, 1892, p. 623) "The Dingo arrived by some chance means of conveyance without assistance, or he may have simply walked overland."

(4) It has been urged that the Dingo is a domesticated dog, which, as the companion of man (in the form of the Australian aboriginal) came to Australia from the North by a land bridge.

(5) It has been argued that the Dingo is a domesticated dog, which came in with the Australian aboriginal, not by a land bridge, but by a sea route.

(6) It has been said to "owe its introduction to early Malay settlers from Asia" (Aflalo. Nat. Hist., Austr., p. 6).

(7) The Dingo has been said to be a domesticated dog introduced by Dutch navigators. Mr. J. Neil McGilp (South Australian Naturalist, vol. ii., No. 3, p. 59) states, "Most people, I believe, think that the Dingo was introduced by Dutch navigators into the Northern Territory." How wide spread this belief may be I do not know.

Such are the opinions that have been expressed; but before we can say anything very definite about the origin or kinship of an animal it is necessary to know the general and specific characters of the type with which we are dealing. Strangely enough, although it is easy to find speculations concerning the zoological affinities of the Dingo, it is a difficult matter to discover exactly what points authors have relied on for their determinations. So far, I have been uanble to trace among the writings of those who have speculated on the status of the Dingo, any indications of precise investigations into the crucial zoological characters of the animal they are dealing with.

(1) McCoy says, "It was certain that the native dogs of Continental Asia were not clearly related, to the extent of specific identity, with the Australian one, nor could any near analogies be found elsewhere."

(2) Lucas and Le Souëf state that "in the anatomy of his teeth and skeleton he seems to be intermediate between the wild dogs of South America and the dogs and wolves of the Old World." Unfortunately the skeletal and dental characters by which this comparison was arrived at are not stated, and the particular wild dogs of South America, with which the comparison was made, are not specified.

(3) Ogilby pictured it as a wild dog which was the ancestor of all domesticated dogs, and Mr. C. M. Woodford gave it as his opinion that "the Dingo is probably the progenitor of the domestic dog of all the Pacific Islanders.

(4) Beddard assumes a non-committal attitude and calls the Dingo "an interesting and somewhat mysterious species of dog or wolf."

That the Dingo is some sort of a dog is practically the only point upon which all writers have agreed. But it is one thing to agree that the Dingo is a dog, and another to agree as to what, zoologically speaking, a dog is. Before precise anatomical points were studied as the criteria for specific distinctions, a vast amount of speculative literature was woven about the problems of the origin of the dog as a domestic animal. In Darwin's Animals and Plants under Domestication (1868) will be found a very good

account of the opinions that had been put forward up to the time of writing this great work. It had been claimed that the domestic dog had his origin in the jackal, in the wolf, or in some species no longer extant. It had been claimed that the domesticated races were polyphyletic—that some had arisen from one wild stock and some from another. It had been claimed also that the origin was a mixed one, and that domestic dogs had arisen by the crossing of various wild stocks living or extinct. This uncertainty still exists in most accounts of the origin of the dog; even our best text-books still hesitate concerning the wild progenitor of the domestic dogs, and most seek safety in hints at polyphyletism. Most of the uncertainty that prevails is due to emphasis laid upon such variable characters as coat colour, and texture, tail and ear carriage, and such other external and conspicuous but highly plastic features. Again, the relative fertility of domestic races with local feral races, or true wild species, has confused the issue.

FIGURE 233.—*Canis familiaris dingo.* The three last upper cheek-teeth of the right side to show the characters of the first molar (middle tooth in figure) which are typical of the northern wolves and domestic dogs.

FIGURE 234.—The three last upper cheek-teeth of the right side of a Jackal (S.A. Mus. M. 1223) to show the characters of the first molar tooth (middle tooth in figure). Note the little platform—cingulum—which runs round the crown of the tooth and which is absent in the northern wolves and domestic dogs.

In the genus *Canis,* to which, as we have seen, the Dingo belongs, there are two main types of animals included. These are the true wolves on the one hand, and the jackals on the other. These two groups of animals differ

from all the others that are nearest akin to them by two definite anatomical characters—the pupil of the eye is truly circular, and the supraorbital processes of the skull are inflated and convex. (*See* Figure 230.) In these two points the wolves and jackals and the dingo differ from the otherwise somewhat similar foxes. All known breeds of dog also fall into the same group as the dingo, the wolves, and the jackals. The only possible ancestor for the dingo, as for other dogs, is, therefore, either the wolf or the jackal. The true northern wolves differ from the jackals in (among other things) the form of the first upper molar tooth. In the jackals this tooth has a platform—the cingulum—running around the outer (labial) side of the crown; in the wolves this platform is reduced or wanting in the middle of its length. (*See* Figure 233.) This reduction of the cingulum on the first upper molar tooth is a wolf specialization—it belongs to the wolves alone; the tooth of the jackals, bearing a well developed cingulum, is of the primitive type, and in this resembles the same tooth of the fox. (*See* Figure 234.) The loss of the cingulum on the first upper molar tooth is the hall-mark of the wolves—but it is also the hall-mark of every breed of feral and domestic dog—and it is the hall-mark of the Dingo. The examination of a series of Dingo skulls can leave no doubt as to the true affinities of the Australian animal. The Dingo falls into line with all other races of domestic dogs in being of the true northern wolf type. Moreover, in the large size of its last upper premolar, or carnassial, tooth it approaches nearer to the ancestral type than do the other races of dogs of which I am able to obtain specimens or records. The following table shows corresponding measurements of a series of skulls of various breeds of dog and 20 specimens of the Dingo:—

Breed of Domestic Dog.	Basal length of skull.	Upper carnassial length.
1. Great Dane (Winge)	255	22
2. St. Bernard (S.A. Mus.)	248	20
3. Large dog (Miller)	230	21·6
4. Mastiff (S.A. Mus.)	230	22
5. St. Bernard (S.A. Mus.)	228	22
6. Dog of the Iron Age from Denmark (Winge)	209	20
7. Average of 10 large dogs (Miller)	200	20·5
8. Greyhound (S.A. Mus.)	195	18
9. Greyhound (S.A. Mus.)	185	17
10. Average of 20 Dingos (F. W. J.)	177	20
11. Chow dog (S.A. Mus.)	170	17

From this it will be seen that the Dingo, as a type, is a dog which possesses relatively very large teeth, a characteristic in which he shows himself nearer akin to his northern wolf ancestors than are most other breeds of dog. Other wolf characteristics are manifested in the Dingo, and among them we may note his habit of silent hunting, and the comparatively inoffensive smell of the animal. In both these ways he manifests a sharp contrast with the jackals. Dogs were domesticated comparatively early in man's history, and they probably have this peculiarity in their

domestication—that they did not become the friends of man on a sudden, by reason of captivity, but rather they passed through successive stages of camp follower, hanger-on, dependant, and finally companion. These phases were passed through so long ago as the later Palaeolithic in Northern Europe, and the earliest remains of dogs so far discovered are in deposits of the Old Stone Age in Scotland and in Denmark. In the early Neolithic the remains of dogs become more frequent, and they have been found at various places in Northern Europe and in deposits of the same cultural period in Egypt and Japan. The dog followed man when he was a mere fashioner of flint and bone at a date which, for those who prefer figures to phases, we may put down at possibly some 10,000 B.C. The dog became man's friend during that newer stone age when pottery and the bow became the triumphs of the arts of peace and war. When we come to think of this astonishing history of the relations of man and dog we need not be upset at the length of time during which that very primitive dog, the Dingo, has been a resident in Australia. The Dingo was in Australia when the great extinct marsupial *Diprotodon* roamed over the country; but so was the aboriginal. The aboriginal and the Dingo have gone together in their Australian wanderings. Almost certainly they came together to Australia in a far distant past as emigrants and by a sea route. The tie between the aboriginal and the Dingo has been loosened in Australia; the Dingo has become feral; but the buffalo has already played the same part in the North, the camel may well do it in the Centre; and the cat has done it all over the continent—the white man's domestic animals tend to revert to the wild in wide spaces as the black man's one pet has done. The Dingo, even in the most remote places, has still a curious hankering after man and his fleshpots. He still falls in behind the buggy, still follows the traveller at a discreet distance, still has a leaning towards hanging on to his camp—and this despite the fact that he is always killed at sight for the price set on his scalp.

There are two common statements made concerning the Dingo which will probably always be held true in Australia despite the fact that the evidence against them being accepted as accurate is overwhelming. The first is that a thoroughbred Dingo is hard to come by, since Dingos are so freely crossed by station dogs. Two facts are worth remembering. The first that, as Mivart has pointed out, the first white men who ever saw Dingos—long before the time of settlement, homesteads, or station dogs—reported them to be of very varying coat colour, and both black and red dogs are mentioned in their first recording. This is good evidence that they are, as we have claimed, domesticated dogs, descendants of the northern wolves, but it cannot be accepted as evidence of recent crossing with the dogs of settlers. The second fact that a series of skulls of Dingos, selected at random from the corpses that have been scalped around northern and north-western cattle stations, shows a degree of uniformity far greater than that seen in any series of skulls of dogs of any breed. (*See* Table

of Skull Measurements.) This astonishing uniformity of skull type in wild dogs, gathered from the vicinity of homesteads, gives no support whatever to the belief that there is any blood, other than pure Dingo, in the Dingos that are poisoned, trapped, and scalped in our oldest settled cattle country.

The second common statement concerning Dingos is that, though they may be taken as young pups and reared by hand, they will always prove treacherous. Though to say anything in favour of the hated wild dog is a treason in Australia, it may be said that this statement, as a generalisation, is very far from being true. A Dingo pup reared as a dog is a gentle, affectionate, and faithful creature; a typical dog at its best, its only drawback is its dismal howl. The howl of the Dingo is its only form of vocal expression, like its ancestral northern wolf, but unlike other dogs, it cannot bark.

The Dingo is distributed throughout the State wherever vermin fences and vigorous efforts at its destruction permit it to exist. In the North-West, in the district around Lake Phillipson, its numbers are very great, a dogging expedition to this country being always a profitable venture. The barriers that prohibited the ancient journeyings of the aboriginal barred the wanderings of his dog, and, fortunately, Kangaroo Island, like Tasmania, was beyond his reach.

Five pups constitute an average litter, and the winter months are those in which most pups are born, August and September being the usual breeding season in this State. In the North the nursery is generally at the bottom of a rabbit hole, most dogs preferring the sandhill country, where rabbits are plentiful.

Wild dogs are immensely more common in some parts of South Australia than they were many years ago; and it is an excellent example of the interaction of life in the maintenance of the balance of Nature, that the invasion of the rabbit has permitted the wild dog to multiply One thing in Australia is certainly capable of dealing with the rabbit plague and that one thing is the Dingo.

Genus 2.—VULPES (Oken, 1816).

This genus contains the foxes of the Northern Hemisphere. Australia's representative was introduced from the British Isles, and belongs to the race which ranges through Central and Southern Europe from Ireland eastwards and from the Baltic to the Pyrenees.

Common Fox.

Vulpes vulpes (Linnaeus, 1758).

The fox was originally liberated in Victoria, being a deliberate introduction made for the purpose of the establishment of fox hunting as a form of Australian sport. Even as such it cannot be said to have been a success,

since to-day Australian fox hunting is done with poison baits and firearms and is a bitter fight against a destructive pest, lacking any traditions save those involved in every determined effort at exterminating an intelligent and resourceful animal.

The original foxes having come from the British Isles, are of the type *Vulpes vulpes crucigera* (Bechstein, 1789), which differs from the typical fox of Scandinavia described by Linnaeus in being predominantly reddish yellow in colour and having small and rather widely separated premolar teeth. (*See* Figure 235.)

Contrary to popular opinion the fox of Australia is no larger than its English forefathers, and it is considerably smaller than the foxes of Northern Europe. The average maximum length and breadth measurements of four typical South Australian skulls are, length 139, breadth 76.7,

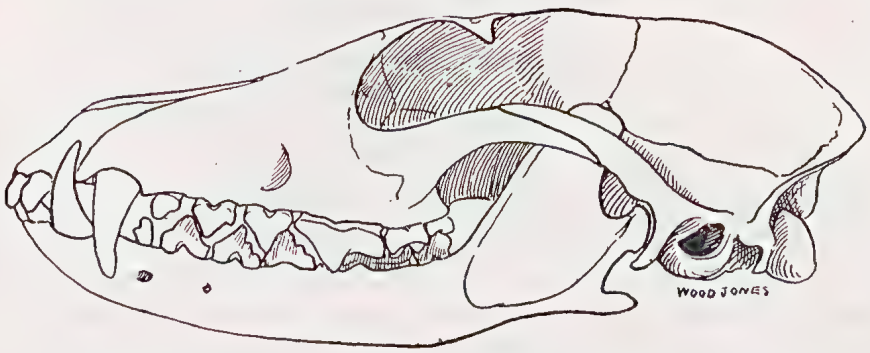

FIGURE 235.—*Vulpes vulpes*. Typical skull of a Common Fox. The specimen from Goolwa, South Australia. Two-thirds natural size.

whereas the average of five British skulls recorded in the British Museum Catalogue is, length 145.8 and breadth 80.3. These figures are decidedly in favour of the home living fox, and those who think the Australian animal has taken advantage of a new country to develop into a larger animal should contrast the South Australian skull averages with the length 154 and breadth 86.3 of a Scottish specimen.

A detailed description of the fox is unnecessary, its characters being so well known.

DIMENSIONS OF SKULL.

Basal length	144	141	136	135
Breadth	75	80	77	75
Breadth of cranium	46	47	46	47
Nasals, length	54	51	52	47
Nasals, breadth	12	14	13	12
Palate length	81	79	74	72
Interorbital constriction	24	25	27	25
Length of row of cheek teeth	55	53	53	54

The fox has spread throughout South Australia with great rapidity, more particularly during the past twenty years, and its advance is still continuing into those very few places where it is not yet firmly established.

Men who are engaged in various agricultural or pastoral enterprises may differ in their estimation of the fox, but zoologists have no difference of opinion; to the student of the Australian fauna the fox represents nothing but calamity. It is quite true that in many parts of this State the marsupial fauna had began to disappear before the advent of the fox; but no one can doubt that the fox is bringing about the closing scenes with great rapidity. Animals that have lived for centuries in country where dingos are by no means uncommon are doomed when the fox comes along. There is not much that a fox will pass by, for it is a picker-up of any living trifle when times are bad. From a zoological point of view the fox probably represents the most baneful disturbing influence brought about by the human folly of introducing animals into a new country.

Family II.—**FELIDAE.**

Genus FELIS (Linnaeus, 1758).

Domestic Cat.

Felis cattus (Linnaeus, 1758).

Cats have run wild in every corner of the State and exist in all stages, from the half-domestic prowler of the suburban fringe to the truly wild cat that lives remote from any human occupation. The feral cats of Australia have a twofold origin; some are mere stray cats which, being in excess of the numbers regarded by man as desirable about his dwellings, have wandered off to shift for themselves; others are those that have been deliberately settled on the land. In various places systematic campaigns have been undertaken for the turning down of cats in the hope of coping with some temporary abundance of rabbits, rats, or mice. Even at the present day it is the custom with some people living outback to take all the kittens of the numerous station cats and dump them in rabbit warrens far out on the runs. In this way an enormous population of marauding feral cats has been established; and this population extends far beyond the confines of human settlement. Not only is the whole of the mainland overrun with feral cats, but they have been introduced in many of the islands of the Bight, in one case with the express purpose of killing out the indigenous native marsupials. Cats swarm on Flinders Island and St. Francis; and unfortunately they have a very strong tenure in Flinders Chase Reserve, at the western end of Kangaroo Island.

Although economically, and in the view of the pastoralist, these feral cats may be considered useful as destroyers of rabbits, it must be owned that from every other aspect their presence can only be regarded as an unmitigated curse. Useful native birds and useful insectivorous marsupials disappear with the advance of the feral cats.

Cats are carnivorous, but it is not only carnivores that man needs to keep pests within limits, he also needs the birds and mammals that eat insects.

The cat destroys the insectivore, and the herbivore alike; grasshopper plagues and caterpillar plagues have to be considered as well as rabbits, and what the cat can do to mitigate the one curse must be weighed, even economically, against what it does to encourage and develop the other two. Apart altogether from questions of economic utility, these feral cats are a terrible scourge, when we consider the vast numbers of the more rare, interesting, and beautiful members of our native fauna that are annually destroyed by them. In Part II., at p. 201, it was noted that since opossums at times inhabited rabbit warrens, a ridiculous belief in the existence of a

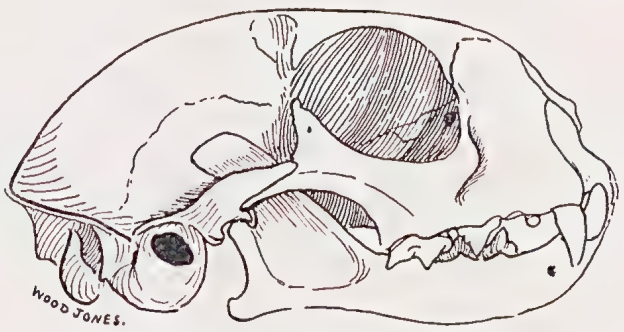

FIGURE 236.—*Felis catus.* Skull of a feral Cat from the western end of Kangaroo Island. Two-thirds natural size.

rabbit-opossum cross had sprung up in Australia. In the same way absurd credence is at times given by the Press to stories of crosses between cats and rabbits, or even between cats and opossums. It is unnecessary to say that these fancied hybrids have no real existence in this or any other land.

DIMENSIONS OF SKULL.

Basal length	90
Breadth	73
Palate length	37
Interorbital constriction	30
Length lower row cheek teeth	23

Feral cats commonly grow to a size larger than that common among the more stay-at-home members of their race. The skull measured is from a typical feral cat from Kangaroo Island, and its measurements exceed those normal for the domestic cat, the increase in the size of the teeth being considerable. (*See* Figure 236.) Herein lies the only zoological interest in the Australian feral cat, since from time to time it attains something like notoriety by reports which declare that strange and terrible carnivorous marsupials have been seen in the bush. That an undiscovered carnivorous marsupial exists in the wilder and more tropical portions of Australia, is, of course, a possibility, but we may credit most of its appearances around the more settled areas of South Australia to a somewhat overgrown feral cat.

Order PINNIPEDIA.

The Order Pinnipedia contains those carnivorous animals which are modified for aquatic life and are known as seals, sea lions, and sea bears. The limbs are modified into swimming paddles; five digits are present both on manus and pes, but they are largely subordinated as individual processes and are involved in the flattened extension of the integument which forms the flipper. On the manus the digits decrease regularly in size from I. to V., but on the pes, digits I. and V. are enlarged, digits II., III., and IV. being considerably smaller than the marginal members.

The teeth are modified for seizing and retaining such slippery prey as fish, and, for this reason, the cheek teeth depart from the type seen in terrestrial carnivora and present a series of simple pointed cones without any cutting or grinding cusps. The tail is reduced to the merest rudiment. The facial vibrissae take the form of harsh stiff bristles. The nostrils are capable of being opened and closed. The eyes are large and prominent.

The whole Order is divided into two main Families, distinguished as follows:—

(A.) Small external ears, hind limbs capable of being turned forwards in terrestrial progression. Family I. *Otariidae.*

(A^1.) No external ears, hind limbs permanently turned backwards and unemployed in terrestrial progression. Family II. *Phocidae.*

Family I.—OTARIIDAE.

This large family of the eared Seals possesses, in addition to the characters used in the above table, the following distinguishing features. The palms and soles of the flippers are composed of naked integument. The cheek teeth have single roots only (in all Australian species). The dental formula for the incisors is I. $\frac{3}{2}$ $\frac{3}{2}$. In the skull there is a well-developed postorbital process, the angle of the mandible is inflected, and there is a passage in the bone of the base of the skull named the alisphenoid canal. The hair is stiff and harsh and there may or may not be a dense soft underfur in the adult. The toilet of the coat is performed by the pes. Very varying subdivisions of the Family have been proposed from time to time, and numerous genera have been defined, the Australian species having been placed in no less than six different genera. Most of these genera are founded on very minor, and often quite inconstant, features, and there is a tendency to-day to regard most of them as undeserving of their rank. Whatever the opinion may be regarding the value of the many genera into which the Family Otariidae has been split, there be be no doubt that the Australian species are not separated by differences sufficiently great to warrant them being placed in different genera.

The genus to which all the described Australian Otarids are here assigned is:—

Genus ARCTOCEPHALUS (F. Cuvier, 1824).

The animals included in this genus may be either "hair" or "fur" seals, for the difference between these two types is simply that the adult hair seal sheds its underfur, whereas this is retained in the fur seals. Both are alike in possessing an underfur when young. In the skull the most noteworthy feature is that the palate extends backwards only to about the mid-point of the arch of the zygoma. The cheek teeth are variable in number, for there may be either five or six upper post-canine teeth in individuals of the same species; and it is by no means uncommon for an animal to have six upper cheek teeth on one side and five on the other.

The nomenclature here employed for the species is not that generally used to designate the South Australian seals. The question of assigning the correct name to an animal is often a very involved one, and the Australian seals have suffered very badly in the matter of nomenclature. The names here employed are, however, those which, so far as the evidence available can take us, rightly belong to the animals. Those who are interested in the question will find the matter fully discussed in the Records of the South Australian Museum (Vol. III., 1925, p. 9). Of this genus there are two species which inhabit the coasts and islands of South Australia, and a third which, though typically a New Zealand form, has often been reported as living on the southern shores of Australia. This third species is included, not because the writer believes it is a member of our fauna, but because it has so many times been reported, probably by confusion, with one of our own species, that it is well to have, at least, its diagnostic features recorded here.

KEY TO THE SOUTH AUSTRALIAN SPECIES.

(A.) Size large, 10-12 feet. No underfur when adult. Adult male with a definite light mane. Nails of pes reaching free edge of webbing between digits.

(1) *A. cinereus.*

(A^1.) Size small, 4-7 feet. Underfur retained when adult. Adult male without a definite light mane. Nails of pes not reaching free edge of webbing between digits.

(B.) Nails of pes falling short of free edge of webbing by considerably more than their own length. Cheek teeth with anterior and posterior secondary cusps. (South Australia.)

(2) *A. doriferus.*

(B[1].) Nails of pes falling short of free edge of webbing by about their own length. Cheek teeth with an anterior secondary cusps only. (New Zealand.) (3) *A. forsteri.*

(1) White-necked Hair Seal, Cowled Seal, Counseller Seal, South Australian Sea Lion.

ARCTOCEPHALUS CINEREUS (Péron, 1816).

The large hair seal or sea lion of our coasts and islands has had scant justice done to it by naturalists, by the general public, or by legislators. By naturalists it has been doomed to a long period of confusion in nomenclature, and to a lack of recognition of its remarkably confined distribution.

It was first named by Péron, who saw it on Kangaroo Island during the stay made there from December, 1802, to February, 1803. Péron seems only to have seen cows and young bulls on Kangaroo Island, for he makes no note, when writing of *Otaria cinerea,* of the white mane of the old bulls; nevertheless there is no doubt that he gave the name *Otaria cinerea* to this species. Afterwards, when he saw the old bulls on St. Peter Island, he noted the white manes and named these animals, in consequence, *Otaria albicollis.* Since 1816, when Péron gave the species two names, the one applying to the females and young males, and the other to the old bulls, under the belief that they were different species, a variety of names has been bestowed upon the animal. In most books dealing with Australian zoology this animal is referred to as *Arctocephalus lobatus* or *Zalophus lobatus,* and sometimes as *Otaria albicollis* or *Eumetopias albicollis.* These names, as well as many others, have been applied to the species, and its own proper name, *Arctocephalus cinereus,* has generally been transferred to the Fur Seal.

Péron named the species *Otaria cinerea* before he used the designation *Otaria albicollis,* and, therefore, the former must become the name of the species. Though this reinstatement of Péron's original name may cause some temporary confusion, it is a necessary change which must be adopted for the permanent clearing-up of the nomenclature of our seals.

The South Australian Hair Seal is the large seal that ranges from the Bass Straits and Kangaroo Island in the East, through the Investigator Group and Nuyts' Archipelago off the coast of South Australia, to the Récherche Archipelago and to Houtman's Abrolhos on the west coast of Western Australia. Beyond these limits it seems to be a mere straggler. This very restricted range of the species is remarkable, and it has not commonly been appreciated by zoologists. It has not been realised that this grand seal has its headquarters on the coast of South Australia and its islands, and from there ranges only as far as Western Australia. According to Lord and Scott (1923), although it has been said to range to

the East as far as the Bass Straits, they have no personal knowledge of its occurrence there. At one time it inhabited the coasts of Tasmania, and I have identified its remains from several kitchen middens of the aborigines of Tasmania.

Arctocephalus cinereus is not a sea-going seal with a wide range: it is a child of the Great Australian Bight, and, as such, should be regarded and respected by South Australians.

FIGURE 237.—*Arctocephalus cinereus*. An old male with well developed mane. About one-twenty-fifth natural size.

The characters of the species as estimated by a casual observer are distinctive in the adults, but not so striking in the young, and it must always be remembered that the estimation of the specific characters of a seal can only be properly arrived at by a complete examination of the animal. Too often a diagnosis is arrived at from a chance view of the animal as it swims in the water or lies basking on the shore. It must be emphasized at once that no sort of guarantee of accuracy lies in such a determination. There is a vast difference in appearance between a wet seal and a dry one, between a male and a female, and between an old and a young specimen. Only an overhaul of the entire animal and an examination of its skull can properly determine its true specific nature. An old bull of this species may be positively recognised by anyone having experience, and it may be recognised with certainty, dry or wet, swimming or on land; but, short of that, the determination of a seal from a mere casual view of the animal is an altogether unsafe procedure.

The adult bull is an animal of great bulk, a total length of ten to twelve feet is about the average for well grown specimens, and the build, especially about the neck and shoulders, is extremely massive. (*See* Figure 237.) In colour, the face, ventral surface of the neck, sides, and dorsal surface of the hinder portion of the body are brown, appearing darker when wet and lighter when dry. The limbs and hind end are more grey, the naked skin being dull black. The most conspicuous feature of the bull is the thickened neck and shoulders, which bear a coarse mane of light yellowish or almost white hair. This light patch of hair borne on the padded, almost humped, neck and shoulders is quite diagnostic of the adult bulls of this species. In younger bulls the back of the neck is paler

FIGURE 238.—*Arctocephalus cinereus.* An adult female. About one-twentieth natural size.

than the general body colour, but the development of the mane and the massiveness of the back of the neck and shoulders is not so pronounced.

The females, which are known among sealers as klapmatches, are considerably smaller, more slim and graceful in build, and are brown on the dorsal surface, with the ventral surface of the neck and the extremities pale yellowish. (*See* Figure 238.) The klapmatches appear almost black when they first clamber ashore and are wet with the sea, but as their coats dry in the sunshine they become a deep, rather rich, brown above and pale yellowish below, without any suggestion of a lighter patch on the shoulders. On several occasions I have had young klapmatches of *Arctocephalus cinereus* pointed out to me, by sailors in the Bight, as

examples of Fur seals; and this promiscuous reporting of Hair and Fur seals from imperfect examination of the animal has done much to confuse the question of the seal fauna at present existing in our waters.

The pups of both sexes are a rich dark brown in colour, and in connection with them another source of confusion is introduced.

Arctocephalus cinereus is classed as a "hair" seal because its pelt is useless as a fur; it cannot be converted into seal skin jackets. The reason for this is that its pelage consists entirely of coarse hair, there being no undercoat or fur. All seals possess this coarse hair coat, but in the "fur" seals there is in addition an undercoat of soft fur which becomes the well-known soft close "seal skin" when the long coarse hairs are plucked out.

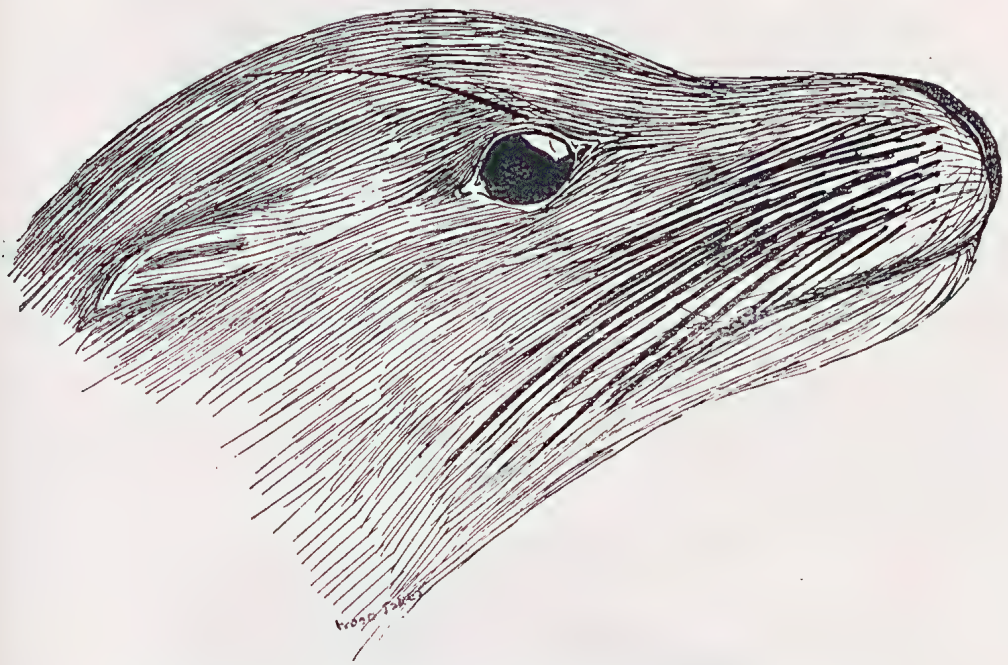

FIGURE 239.—*Arctocephalus cinereus.* External characters of the head of a young male pup.

If the long hairs be plucked from an adult *Arctocephalus cinereus* nothing is left but the bare skin; the pelts of the South Australian Sea Lion have, therefore, no value except as hides for the preparation of leather. The pups of *Arctocephalus cinereus,* like the adults of the "Fur Seals," have, however, an abundant undercoat. This fact is well known in the fur trade. Marcus Petersen (Fur Traders and Fur-bearing Animals, 1914, p. 225) says of the Australian Hair Seal:—"The cubs have a soft thick underfur, which, however, disappears in the adults." This is an absolutely correct statement of the facts, but it is often not recognised locally, for pelts of young examples of *A. cinereus* have more than once been submitted to me as the true specimens of Fur seals. This undercoat of fur is shed at a comparatively early age in both bulls and klapmatches, for the young adults of both sexes show only the coarse hairs of the outer coat. In

addition to the specific characters of the coat, other external characters may be noted. The iris is a rich dark brown, the eyes are large and prominent, with a dog-like, almost pathetic, expression. The naked parts of the skin are black. The facial vibrissae are reduced to the stiffest bristles. (*See* Figure 239.) The mysticial set is well represented with the coarse, long,

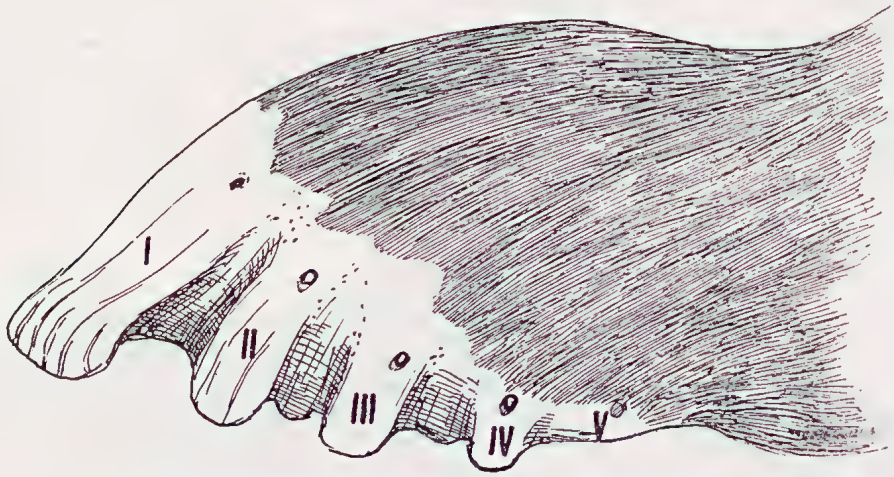

FIGURE 240.—*Arctocephalus cinereus.* Left manus of a young pup.

almost horny whiskers. There is a well-developed supraorbital vibrissa. The external ear is reduced to a small tag of skin which lies closely adpressed to the side of the head. The manus is more reduced and more profoundly altered than the pes. It consists of a flipper upon which the digits are represented as naked appendages in decreasing perfection from

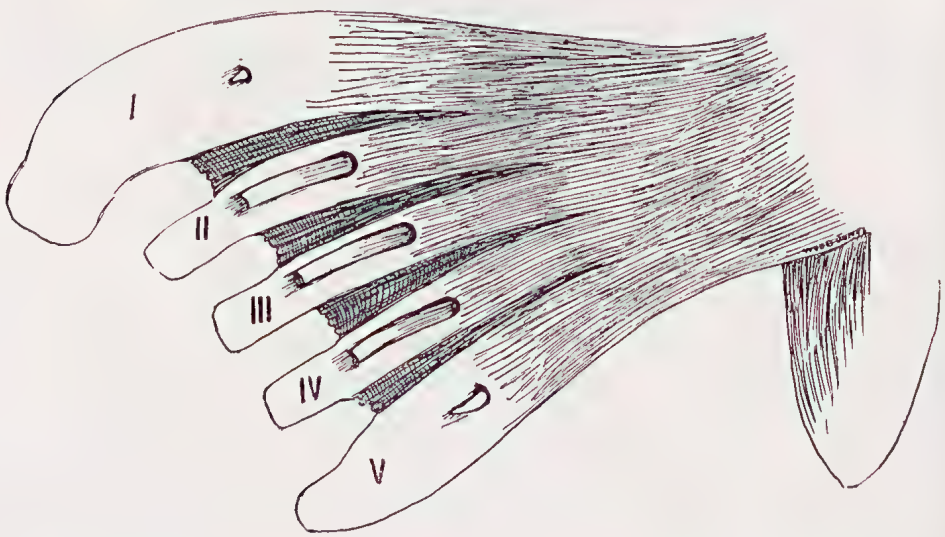

FIGURE 241.—*Arctocephalus cinereus.* Left pes of a young pup. Note the nails ending at the edge of the web.

I. to V., the nails are rudimentary and are represented only on digits II., III., and IV. as true horny remnants. (*See* Figure 240.) The pes has well developed nails on digits II., III., and IV. and rudimentary nails

on digits I. and V. The nails on digits II., III., and IV. reach to the extremity of the webbing between the digits. Beyond the extremity of the nails the free leathery ends of the digits are continued as flattened processes, each pedal digit being represented by a well developed naked process, of which digits I. and V. are considerably the largest and longest, although their nails are the smallest. (*See* Figure 241.) In all operations for the toilet of the coat the pes is employed, the manus and forelimb never engaging in this function. In its functional use in the toilet the pes undergoes a modification, for the naked spatulate extremities of the digits can be folded so that the free ends of the nails protrude.

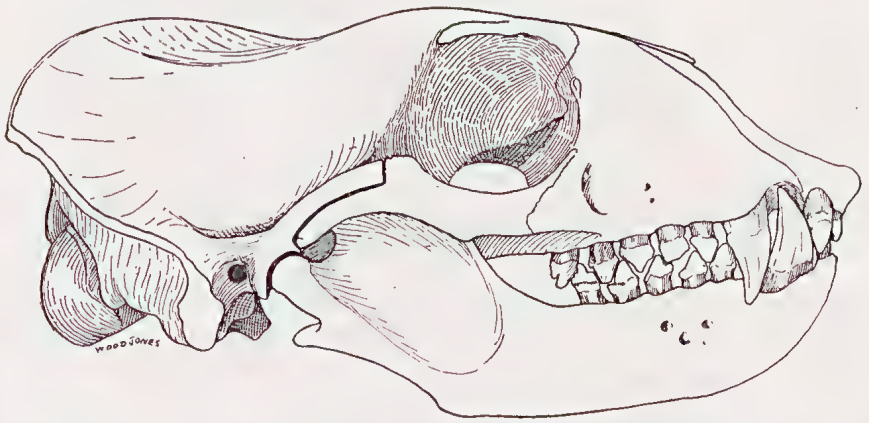

FIGURE 242.—*Arctocephalus cinereus.* Lateral aspect of the skull of an adult male. One-third natural size.

Scratching the fore part of the body with the nails of the pes is a frequent occupation of the sea lions when basking on the rocks or sandy beaches of the shore.

There is a marked sexual difference between the skulls of males and females. (*See* Figures 242 and 243.) The skull of the male is large and massive, the crests and ridges for the attachment of the muscles are very pronounced, and the hinder end of the skull, where the powerful neck muscles are attached, is very different in the two sexes. The interorbital constriction is well marked, but the whole interorbital region is relatively short, rounded, and somewhat inflated. (*See* Figure 244.) The zygomatic arch has no very prominent post-orbital process.

DIMENSIONS OF SKULL.

	♂	♂	♂	♂	♂	♂	♀	♀	♀	♀	♀	♀
Basal length	300	296	294	292	286	286	252	244	243	242	241	238
Breadth	173	152	161	171	166	166	128	125	122	120	124	126
Nasals, length	54	52	49	55	45	49	38	33	35	33	38	37
Nasals, breadth	41	35	35	48	36	38	29	25	27	26	25	27
Palate length	158	150	152	156	148	153	130	124	122	122	117	120
Inter-orbital constriction	56	53	43	53	39	49	52	51	43	43	44	41

The dental formula is variable, since the number of the cheek teeth is not constant. There may be five or six teeth in the upper jaw behind the canines; whatever the number, however, the cheek teeth are in a continuous series and are single rooted. (*See* Figure 245.) In a series

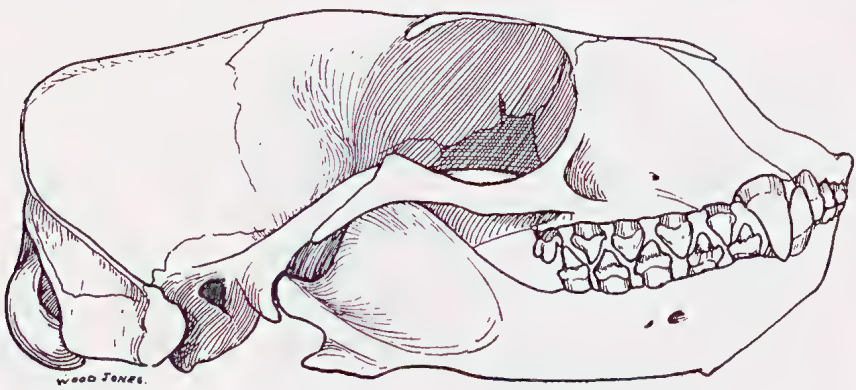

FIGURE 243.—*Arctocephalus cinereus.* Lateral aspect of the skull of an adult female. Two-fifths natural size.

of skulls from one locality the formula for the cheek teeth is as follows:—Males, $\frac{5}{5}-\frac{5}{5}$ in 4 examples, $\frac{6}{5}-\frac{6}{5}$ in 3 examples, $\frac{5}{5}-\frac{6}{5}$ in 2 examples, and $\frac{6}{5}-\frac{5}{5}$ in one. Females, $\frac{5}{5}-\frac{5}{5}$ in 6 examples, $\frac{6}{5}-\frac{6}{5}$ in one example, and $\frac{6}{5}-\frac{5}{5}$ in one. The formula may therefore be I. $\frac{2-2}{2-2}$ C. $\frac{1-1}{1-1}$ cheek tooth $\frac{5-5}{5-5}$ or $\frac{6-6}{5-5}$.

The great canines are very much more developed in the males than in the females. *A. cinereus* is not a sea-going or a migrating seal, it is an animal of a peculiarly stay-at-home and domestic nature. It is not a visitor to our shores, it is born and bred, and, were it not for human intolerance, would spend all its life upon our coasts and islands. It shows a pathetic attachment to its ancient home, and surely there can be few things more distressing than the accounts of the rushing for guns and harpoons—the heroism of local residents in the maiming or slaughter—when one of these trusting creatures comes ashore on the humanly populated portions of its ancestral home. At no season does it range far away, it is content to lie on the beaches in the sun during the day and to go to sea for its food when hunger urges. The beach on which it is born would be the beach on which its old age were spent—were there no interference from man.

It breeds but once in the year and each adult klapmatch produces but one pup. The breeding season is from October to early in December, and at that time the whole seal community spends most of its time ashore. In some cases each old bull is the lord of only one klapmatch, but at times he has two or three or even more in his harem. The klapmatches retire to the deepest clefts between the granite boulders of the islands, and the old bull remains upon some prominent boulder, constantly upon the watch-

ever ready to defend, ever ready to attack. The pups are born at the end of the year, and are the objects of the utmost solicitude on the part of the klapmatches and of the utmost jealousy on the part of the bulls.

At this time, anyone landing on the islands and unaware of the habits of the seals might be inclined to consider them savage and aggressive, for should he chance near the retreat of the klapmatches he is sure to be challenged by a charge and a roar from the old bull who guards them. The encounter with an old bull, of great bulk and extremely agile withal, by one unaware of the cause of his hostility, is apt to be a somewhat alarming experience. But in these encounters nothing more than tact is

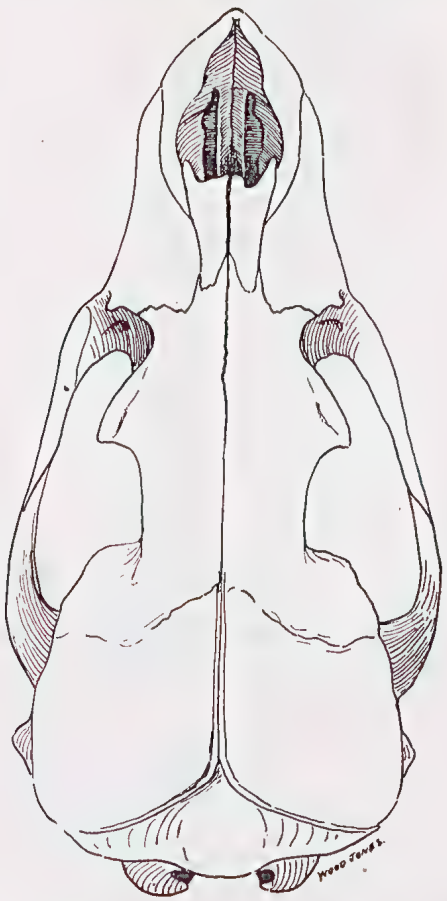

FIGURE 244.—*Arctocephalus cinereus.* Dorsal aspect of the skull of an adult female. Two-fifths natural size.

demanded. When once the bull realises that you are prepared to avoid the place where the klapmatches and pups are concealed he will permit you to pass to and fro without the least hindrance. It is only stupidity or cupidity that brings man into conflict with a bull hair seal during the breeding season. The monarch of a harem may be visited daily as a friend by anyone prepared to respect the family pride and psychology of the seals.

During the breeding season the seals go but little to sea. The old bulls remain on some prominence keeping guard over their harems; the young

bulls and klapmatches bask on the beaches. During December and January the seals come ashore and lie for days, dozing and waking at intervals, contentedly upon the upland slopes of the islands. As during this period they are, for the most part, not sea-going, they derive their food supply locally, and mainly subsist on the numerous penguins which live with them on the islands. Penguins may be captured as they leave the rocky holes

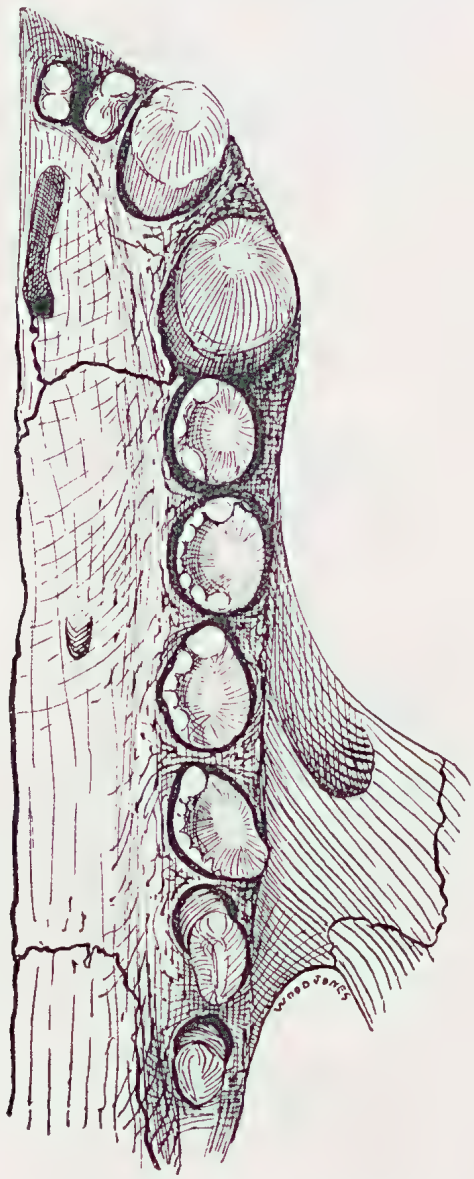

FIGURE 245.—*Arctocephalus cinereus.* Upper teeth of the left side of an adult male in which there are six cheek teeth. Natural size.

for the sea, as they waddle across the sandy beaches, or across the flats of the island. They may be captured anywhere between the holes on the plateau three hundred feet above and the surf into which they plunge on the sea shore. Penguins young and old undoubtedly constitute the food supply for the majority of breeding seals, and the commonly re-quoted

statement that "at this period seals rarely enter the water and consequently do not feed" is not true of the present species. When not assembled for breeding in the rookeries, the seals feed on fish, and for this reason every fisherman is the seal's enemy. But the fisherman's hatred for the seal is perhaps not founded on any very logical basis. For one seal which now haunts our coasts there were several hundreds in the good old days when, as fishermen affirm, fish were more abundant. Were the last seal to be slaughtered the fishermen would probably see no increase in the abundance of fish. There is more in the balance of Nature than this crude relation of fish-eating seals and a real, or fancied, diminution in the number of fish. It is probably true to say that more fish are eaten by fish than by any other animal; the fisherman who wants to catch snook baits his hook with snook, and for all he knows an animal that devours fish may increase, rather than decrease, the total number of fish, by destroying fish-eating fish.

In South Australia we are so ignorant of the life histories of our fishes that we cannot tell their friends from their enemies; but at least we can say that the re-establishment of seal rookeries by legislation in other parts of the world has not led to a diminution of the supply of food fish. It is, therefore, difficult to have complete sympathy with those who are for killing off every seal on the coast, on the ground that they are the ruin of the fishing. The seals will, at times, kill large fish which they are unable to swallow, and then they are faced with a problem, for their teeth are adapted to seizing and piercing, but not to biting up, their living prey. I have watched, for hours on end, a seal play with a large Fiddler (*Trygonorrhina fasciata*), a member of the ray family some 3 or 4 feet in length. Unable to bite it, it seized it in its mouth and, rising above water, shook it, as a dog shakes a rat. The sharp teeth gripped some outlying part of the Fiddler, and as, with a great shake, it flung the heavy fish away, some chunk was ripped from its body and devoured. It was then that the strange play instinct of the carnivore asserted itself, for the seal pretended to have lost the fish, and, with a marvellous display of dexterity in the water, came on it again apparently by chance. As the body sank, the seal circled around and beneath it and seizing it again, had it at the surface and tossed it far into the air. In this fashion a long summer afternoon was spent, the water being broken by the swirl of the playing seal and by the splash of the great fish, as, tossed into the air so that its white belly gleamed in the sun, it fell with a smack as its flat body met the surface of the sea.

Although seals are such thoroughly aquatic animals and show so complete a mastery of their chosen element, the pups are only permitted by their mothers to go to the sea when they are grown to a fair size. Even then the first visit to the sea is a period of great anxiety for the mother. The pup is coaxed into the water, and, guided by the mother's flipper, takes its first swim. Its every action is directed by the mother, and whenever it becomes too enterprising she keeps to its seaward side to head it back to

land again. The whole business is as pretty a demonstration of maternal care among the mammals as could well be witnessed. The same care as is shown by the mother for her pup is shown by the bull for his klapmatches. Seals are extremely inquisitive animals, and they take the greatest interest in man and all his doings, and this characteristic is particularly noticeable in the young females. If a basking bull and several klapmatches are surprised from the landward side, he will always drive the whole crowd to sea; if the danger is imminent he will slowly enter the water after them; but if he is not pressed he will remain near the water's edge between his harem and the intruder. Before long the inquisitiveness of the females gets the better of them, and, one by one, they emerge from the water to have a nearer view of the stranger. This the bull will not permit, and he orders them back with a roar, a roar that preludes a charge if they insist in an endeavour to come ashore in order to make friends. Than the alert patience of an old bull on guard over his klapmatches and their pups there is no better picture of fidelity. Seals are sometimes reckoned as savage animals, and, indeed, an angry old bull well over ten feet long and of huge bulk is a formidable creature. But there are only two circumstances under which they may become dangerous to one who does not intentionally molest them. The first is when intrusion is made upon the place where a bull has herded his harem during the breeding season, and the second is when one gets between a seal and the sea on the only possible track from the top of an island to the beach. In both cases a judicious withdrawal is all that is necessary in order to restore peace.

When unmolested, seals are naturally friendly to man, and they show a dog-like aptitude for human society. After living for a week in the rookery on Pearson Island, during the breeding season, every member of the expedition could approach the seals in familiarity and pat them on the head as they lay on the beaches. They will follow a boat to and from the shore, follow a man as he wades or swims among the boulders, and look with mild eyed curiosity as he walks about the beach upon which they are basking. They resent intrusion by a series of deep sniffs, which can develop into a harsh bark or a deep roar in the case of the old bulls. Their pace on land is altogether surprising, and the rate at which they can gallop across a stretch of sandy beach would never be imagined from a study of their highly modified limbs. Their power of climbing up cliffs is also very remarkable, and on some of the islands in the Bight there are tracks, up which a man can climb only with difficulty, which are made and used regularly by the seals as they go from the sea to the island plateau nearly three hundred feet above. During the breeding season there is a social division on the rookeries, for the old bulls and their harems each have their own recognised portion of the rock-strewn coast and the young bulls and klapmatches foregather on their own beaches. There are evidently frequent and severe fights among the bulls for the possession of the klap-

matches, for old bulls generally show a multitude of great scars on their bodies.

Seals of this species wander at times far from the sea coast; they may be found at any time high on the plateau of all the larger islands of the Bight where they do not fear molestation from man. Quite recently one was met with more than six miles from the shore on the West Coast of this State. When, as happened in the most recent instance of inland wandering, they find a temporary home in some waterhole, they may be possible claimants to the distinction of being the original of the Bunyip myth.

There is one curious habit of seals which has never received an adequate explanation. For some reason or other they swallow pebbles which lodge in their stomachs. In the case of *A. cinereus* the pebbles are of granite, and range in size from a tennis ball down to a walnut; depending upon their size their number varies from half a dozen to forty or so. The weight of this mass varies; a typical set of twelve faceted stones weighed five pounds, but in many cases this weight is considerably exceeded. When and why this strange cargo is obtained are problems for which many people have sufficient solutions, but the real understanding of which remains wanting.

The number of our Hair Seals has been sadly reduced, and though there are many who would wish to see the destruction carried further, no thinking person can contemplate without disgust the revolting details of that orgie of brutality which has been termed "sealing" in these waters.

There are nominal sanctuaries for seals along the coast, and the value of the pelt of *A. cinereus* is extremely small; but there is unfortunately that about a basking seal which calls forth all the innate brutality of a certain type of ruffian. Sealing should be strictly regulated not only by enactments, but by the enforcing of these enactments, and this not only for the reason that it is a brutalising and economically unnecessary and wasteful business, but because our great Hair Seal is a creature of our own coasts, peculiar to our State and ranging only a little way beyond its boundaries.

(2) Australian Fur Seal, Sea Bear.

ARCTOCEPHALUS DORIFERUS (Wood Jones, 1925).

The small Fur Seal which formerly was extremely abundant on the coasts and islands of South Australia has usually been known under the specific name of *cinereus*, which, as we have seen, properly belongs to the much larger Hair Seal. When Péron was in Kangaroo Island, from December, 1802, to February, 1803, he saw the Hair Seals, which he named *Otaria cinerea*; but he also noted "the much smaller seals with fur of good quality." These smaller Fur Seals he did not name in any of his writings that have survived; but, in his account of his travels, he mentioned that he was preparing a monograph on the seals. This monograph never saw the light of day, and so we do not know if Péron ever named the "Phocaces plus petites" of Kangaroo Island.

Messrs. Quoy and Gaimard, during the voyage of the *Astrolabe*, obtained a small Fur Seal from Western Port, and wrongly identified it as Péron's *cinerea*, and here began the confusion in names: the name which was given to the large Hair Seal was by mistake transferred to the small Fur Seal, and ever since 1803 our Fur Seal has been misnamed.

No information about the Fur Seal of Kangaroo Island has, so far as can be ascertained, been recorded, and all accounts in Australian literature are taken from the excellent description given by McCoy in 1882. McCoy's observations were made on animals living on the Seal Rocks off the Nobbies, on the coast of Victoria.

Most of the details concerning this animal which are recorded here have been furnished by Mr. C. J. May, the Ranger of Flinders Chase Reserve, on Kangaroo Island. Mr. May in his younger days had abundant opportunities for observing the animals, for he was frequently a member of the very mixed parties that carried on the work of sealing round the coasts of the

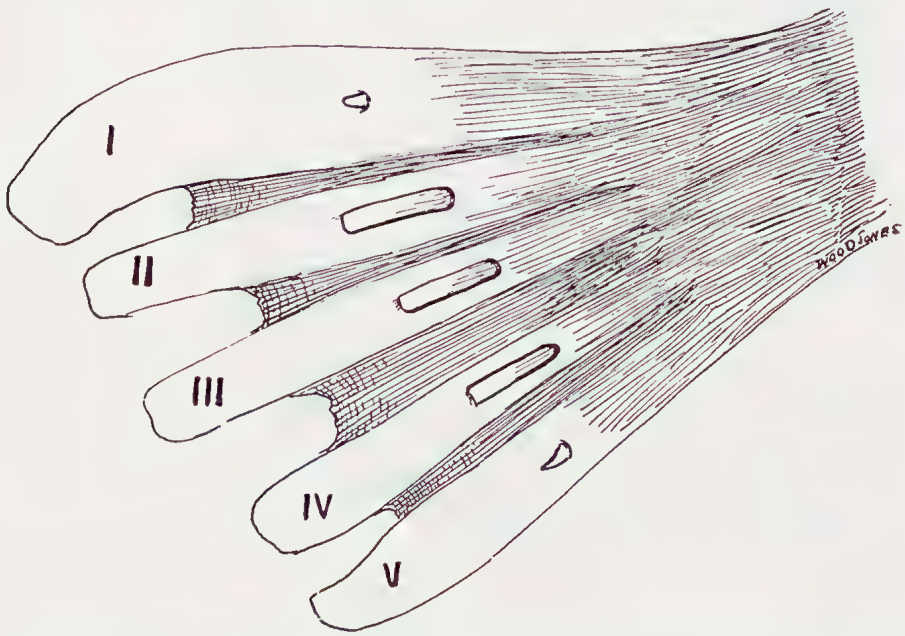

FIGURE 246.—*Arctocephalus doriferus*. Left pes. Note the nails ending far from the edge of the web.

Island. Among the sealers, the male Hair Seals were known as bulls, but the male Fur Seals were termed wigs and the females, as with the other animal, had the curious name of klapmatch. A full grown wig measured about six feet from nose to tail, but the general run of them on the islands were somewhat smaller. A klapmatch five feet long was a large specimen. Unlike the Hair Seal, the sexes are not so different in their general appearance, but the wig is much heavier about the shoulders and the hair on the back of his neck is longer. In general colour the sexes differ but little, and, when they first haul out on the rocks and are wet, both wigs and klapmatches appear to be almost black. When dry, the back becomes greyish or yellowish brown and the ventral surface very dark brown.

In both sexes the underfur beneath the coarse outer hair is of a rich warm chestnut colour, and it was due to the presence of this fine underfur that the animal was slaughtered.

The pes differs greatly from that of the Hair Seal, for the prolongations of the middle three toes are practically the same length as those of the marginal toes, and the free tips of the nails fail to reach the free margin of the webbing by more than the length of the nail. (*See* Figure 246.)

There is no such marked distinction between the skulls of the two sexes as is seen in the Hair Seal. Even the old males have skulls on which the

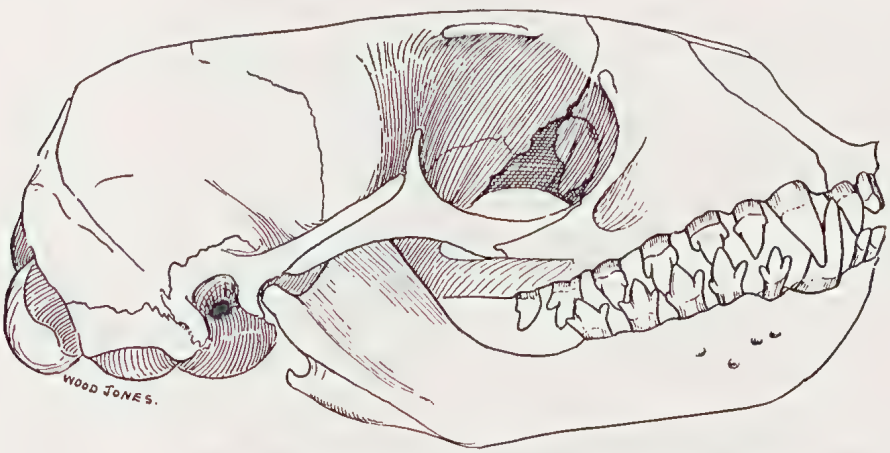

FIGURE 247.—*Arctocephalus doriferus.* Lateral aspect of the skull of an adult. Half natural size.

ridges for the attachment of muscles are of only moderate development. (*See* Figure 247.) The interorbital constriction is well marked and elongated, the rounded brain case behind being sharply differentiated from the narrow tubular constriction. (*See* Figure 248.) The zygomatic arch has a well developed postorbital process.

DIMENSIONS OF SKULL.

	S.A. Mus. M. 627.	S.A. Mus. M. 1268.
Basal length	202	125
Breadth	111	107
Nasals, length	32	30
Nasals, breadth	20	21
Palate length	90	93
Interorbital constriction	32	29

The dental formula for the cheek teeth varies from $\frac{6-6}{5-5}$ to $\frac{5-5}{5-5}$ and, as in the case of the Hair Seal, the upper teeth may differ in number on the two sides of the mouth. The cheek teeth are in a continuous series and they are all tricuspid except the last upper molar, which is frequently irregular in form.

The Fur Seal is far more given to going sea voyages than is the case with the Hair Seal, and in the days of its abundance it only congregated at the rookeries during the breeding season. At this season vast numbers came to the islands, before their indiscriminate slaughter by the sealers had played havoc with their numbers. They did not, as a rule, frequent beaches or islands in company with the Hair Seal, but preferred the smaller rocky and more inaccessible islets. Here they would come at the end of October, and practically all the pups were born within four days of Christmas Day. The old wig drove his klapmatches ashore, and generally herded them into a convenient gully in the rocks or, on one island, into

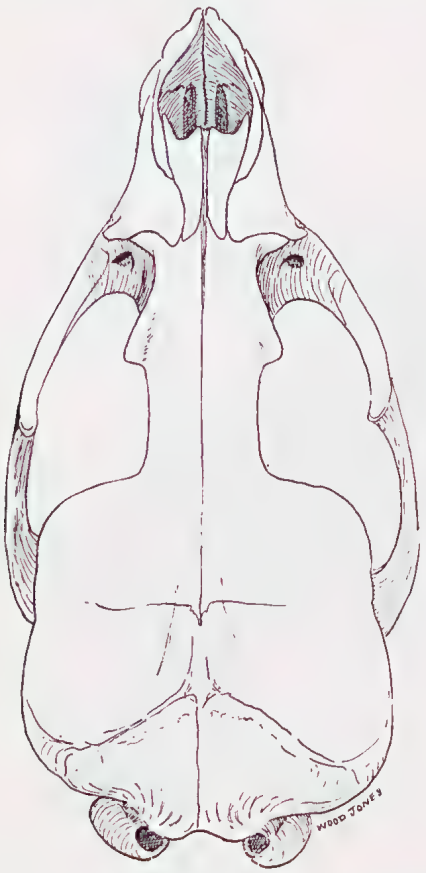

FIGURE 248.—*Arctocephalus doriferus.* Dorsal aspect of the skull of an adult. Half natural size.

large caves, where they could easily mount guard over them and keep all other wigs away. Each wig was lord over a large number of klapmatches, and sealers have several times killed as many as fifty klapmatches which were all in the herd guarded by one old wig. As in the case with other gregarious seals, fights between the wigs for the possession of the klapmatches were common, for every old male in charge of a little herd was repeatedly challenged by rivals and no challenge was ignored.

The range of the Fur Seal was at one time a wide one around the Australian coasts; now it is restricted to very few isolated spots. The last

large haul of skins from Kangaroo Island and its outlying rocks was made nearly forty years ago, and it is very doubtful if a Fur Seal has been seen on the Island since then. I have been told of much more recent cases of fur sealing; but after six visits to the islands of Nuyts' Archipelago and the Investigator Group I have not seen a Fur Seal. Such evidence does not amount to much, since Fur Seals are not continuously on the islands throughout the year; but though hundreds of corpses, relics of former raids, have been examined, and skulls and portions of skulls of a very large number of individuals have been overhauled, no remains of a Fur Seal have as yet come to light from any island in the Bight. On the shores of D'Estree Bay, in Kangaroo Island, a sea-worn skull was picked up in March, 1925, and this skull, although fragmentary, is undoubtedly that of a Fur Seal. It is practically certain that the animals still live on the inner Casuarina Island, which was one of their great strongholds in the old days, and from which only thirteen years ago twenty fur seals were said to have been taken. Since this island has been proclaimed a sanctuary and is in constant view of the lighthouse at Cape du Couedic, it may be that South Australia may yet make amends for the past. If the remnant of a herd is left, and this remnant is rigidly protected, it is possible that a most valuable industry could be re-established, were this industry carried on under sane and strict supervision.

From the seal islands of Tasmania the Fur Seal was almost exterminated, but protection there has lead to the re-establishment of some small herds. The specimens of this animal in the museums of Australia are altogether insufficient; though countless thousands of skins have been exported, it would be difficult to procure, in the scientific institutions of the Commonwealth, enough material to make a satisfactory scientific examination of the animal as a species.

(3) New Zealand Fur Seal.

ARCTOCEPHALUS FORSTERI (Lesson, 1828).

By several Australian zoologists *A. fosteri,* which is typically an inhabitant of New Zealand and the Subantarctic Islands, has been included in the seal fauna of Australia. There is no doubt that, at times, this name has been used because the author believed the Australian and New Zealand species identical; at times, because in 1866 Grey confused the two species; and, at times, simply because the account of some earlier author was merely copied for a later work. There is no doubt whatever that the Australian and New Zealand Fur seals are different animals, and if the New Zealand form visits our coasts, or is permanently settled on any islet, is a matter that can only be settled by a systematic overhauling of what little authenticated material exists in the museums of Australia, and by a much needed scientific survey of our existing seal rookeries. Until these studies are carried out the matter must remain in doubt.

Of *Arctocephalus forsteri* the wigs are from 6-7 feet in length, whilst the klapmatches are about a foot less. The adults of both sexes have the dorsal surface dark brown, grizzled with white-tipped hairs, and the ventral surface reddish brown. There is a fine red-brown underfur beneath

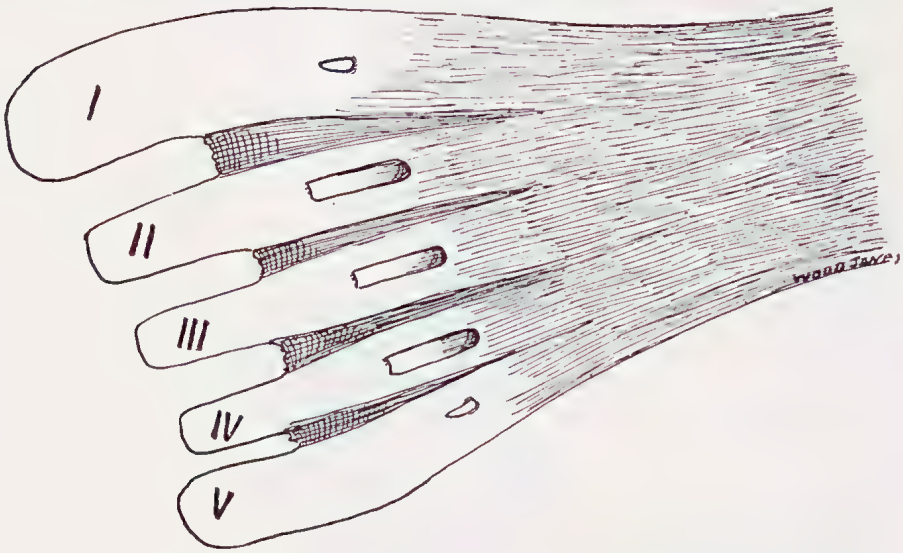

FIGURE 249.—*Arctocephalus forsteri.* Left pes. Note the nails with their free tips separated from the free edge of the web by about the length of the nail.

the hair which is retained throughout life. The pes has the prolongations of the middle three digits only slightly shorter than the marginal digits, and the tips of the nails of the middle three digits fall short of edge of the webbing by about the length of the nail. (*See* Figure 249.) The skull is

FIGURE 250.—*Arctocephalus forsteri.* Dentition: note the anterior cusp on the cheek teeth; the posterior cusp is lacking (after Clark).

in general, very much like that of *A. doriferus*, but the teeth are easily distinguished, since they have only an anterior secondary cusp, instead of the anterior and posterior cusps characteristic of that species. (*See* Figure 250.)

Like *A. doriferus* of Australia, the Fur seal of New Zealand has been almost exterminated by indiscriminate sealing; but Mr. Edgar R. Waite has recorded that there are signs that it is reoccupying some of its old haunts, and that, if poaching were altogether stopped, it would probably become thoroughly re-established.

In the South Australian Museum there is a mounted specimen of this animal, but being part of the old collections, no record exists of its place of origin.

Family II.—PHOCIDAE.

This family contains what may be termed the True Seals in opposition to the so-called Sea Lions and Sea Bears of the Family Otariidae. All members are devoid of any external ear, and the hind limbs are more modified from the common mammalian type than they are in the Otariidae, since they are turned completely backwards and function only as a swimming organ, which is useless for progression on land. The members of this family, therefore, wriggle on shore when undisturbed, but if pressed become more active, when they progress by a series of jumps. On the other hand, the sea lions waddle at a leisurely gait or gallop with a looping action when hurried.

The palms and soles of the flippers are hairy. The cheek teeth (except the first) have two roots. The dental formula for the incisors (in all Australian species) is I. $\frac{2-2}{2-2}$. No postorbital processes are developed in the skull, and the alisphenoid canal, which tunnels the base of the skull in the Otariidae, is absent. The angle of the mandible is not inflected. The hair is stiff and lies close to the body, there being no underfur. The toilet of the coat is performed by the manus.

There are no True or Earless Seals resident upon our coasts, but two species, normally inhabitants of the Antarctic seas, have been recorded as visitors to South Australia. These two species belong to different genera.

Genus LEPTONYCHOTES (Gill, 1866).

The seals of this genus have typically broad flat heads and rounded muzzles. In the skull the great width of the cranium characteristically exceeds the breadth across the zygomata. The skull in general is flattened from above downwards. (*See* Figure 251.) The post canine teeth are small, the last member of the series being the smallest.

Weddell's Seal.

Leptonychotes weddelli (Lesson, 1826).

Weddell's Seal, which was formerly regarded as one of the rarest of all the seals, is now, thanks to the work of our Antarctic explorers, known to be one of the most abundant of the typical Southern Phocids. It is a fairly large seal, the adults measuring upwards of nine feet, and in general

it may be described as a fat, rounded, animal with a short, pug dog-like face. A nine-foot animal will weigh as much as 900 pounds. The coat is greyish in colour and is freely marked with irregular blotches and spots of white. In its Antarctic home it is a frequenter of the coasts rather than of the sea ice, and from the accounts of those who have lived in its company, it appears to be a stay-at-home, gentle and peculiarly lethargic creature.

It is said that a great deal of its time is spent in dozing, and that it has little objection to being used as a seat by man, of whom it seems to have no natural fear.

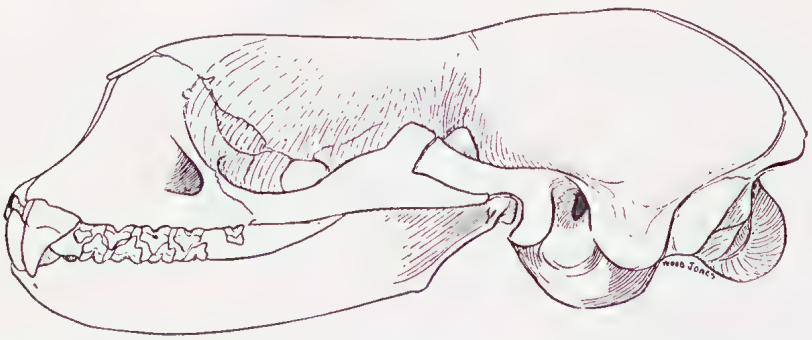

FIGURE 251.—*Leptonychotes weddelli.* Lateral aspect of the skull of an adult female specimen. One-third natural size.

Although it is naturally such a passive and stay-at-home creature, showing no tendency to roam from its Antarctic coast line, stragglers are occasionally reported from other lands. Weddell's Seal has visited New Zealand, and a particularly fine specimen made the journey to South Australia. This specimen, which is displayed in our State Museum, became entangled in the fishermen's nets at Encounter Bay.

GENUS HYDRURGA (Gistel, 1848).

The head and skull are elongated, the muzzle hairy to the edge of the nostrils and between them. The cheek teeth have three pointed and

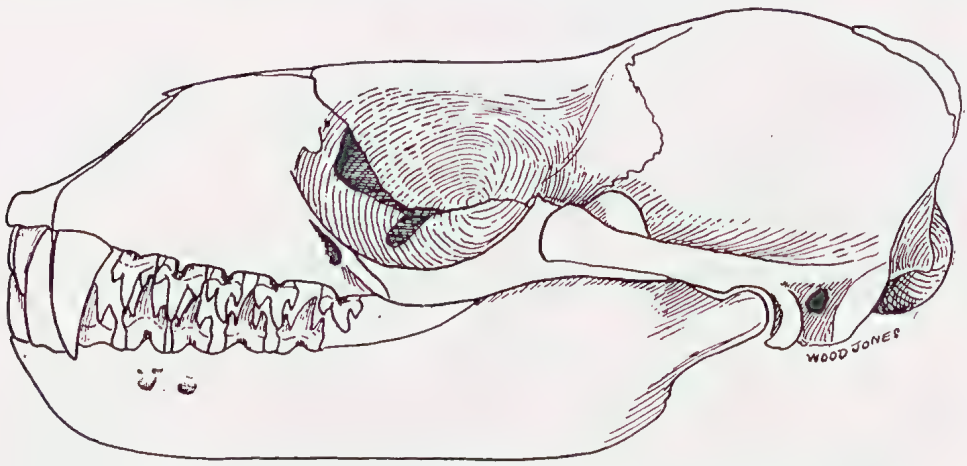

FIGURE 252.—*Hydrurga leptonyx.* Skull of a Leopard Seal. (South Aust. Mus. No. M. 1270.) One-third natural size.

somewhat curved cusps, the middle cusps being the longest. (*See* Figure 252.) The only member of the genus is an occasional straggler to our coasts.

Sea Leopard. Leopard Seal.

HYDRURGA LEPTONYX (de Blainville, 1820).

This Southern animal occasionally wanders to the coast and islands of South Australia, and many of the specimens reported have been in an exhausted condition when they came ashore. The animal is elongated and built on fine lines, and the long head and formidable teeth give it a graceful and yet fierce aspect, which, coupled with the spots that mark its sleek hide, make its popular names very appropriate. The general colour is ashy grey above, marked with spots and blotches of dirty white and irregular spots of black. The underside is dirty yellowish or greyish white. The agility and ferocity of the animals have greatly impressed those who have encountered them on our beaches, and from the accounts of those who have battered the life out of these rare visitors, it can only be concluded that they are endowed with an extraordinary vitality. It has been recorded from Port Lincoln, Port Wakefield, Encounter Bay, from two localities on Kangaroo Island, the Althorpes, and the Neptunes. The most recent visitor was killed in 1920, but no part of the animal was preserved for science.

ORDER CHIROPTERA.

The bats are so distinguished by several anatomical features as highly developed creatures that the great naturalist, Linnaeus (1707-1778) placed them with the lemurs, monkeys, apes, and man in his Order Primates. The characters upon which Linnaeus relied in so classifying the bats may appear to us to be altogether unworthy of reliance, and by common consent the Chiroptera are now removed from the Primates and placed in an order of their own. Nevertheless, we must admit that, though showing no really intimate kinship with the lemurs, monkeys, or man, the bats form an Order which is rightly placed next to the Primates in zoological precedence.

Possessed of the power of flight, their range is world wide. Islands having no other Mammalian fauna are often the haunt of bats which have occupied their island home for so long a time as to have become modified into distinct species. New Zealand has its own bat fauna, and there is every reason to believe that Australia received its bat colonists at a very early date.

Of the geological history of the Chiroptera little is known, but such facts as have come to light are very remarkable. Bats were in every way true bats in times as remote as the deposition of the beds of Upper Eocene

formations, and even at this early period their specialization is so far advanced that no clue is given as to their ultimate derivation. In Australia bat remains are frequent in cave deposits, the species so far found being either identical with, or very similar to, those living in the caves to-day.

Bats, being such highly specialized creatures, presenting so many modifications from the ordinary type of mammalian structure, need for their proper description rather different treatment from that employed for the rest of the mammals. The introduction of a new set of descriptive terms cannot, therefore, be avoided, and it must be remembered that though these terms may appear to add considerably to the student's difficulties,

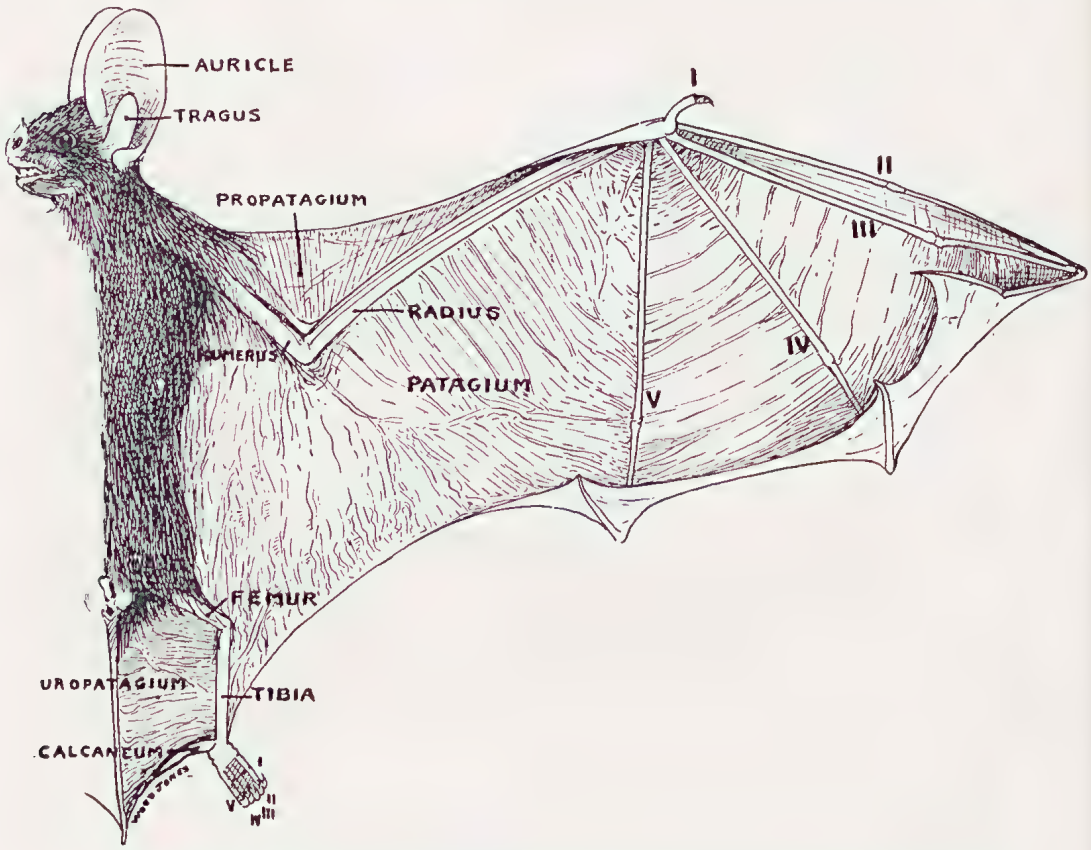

FIGURE 253.—Diagrammatic outline of a Bat to explain the principal terms used in the description of a species.

they are absolutely essential for the proper description of any species. One species of bat cannot be distinguished from another without a detailed description of parts and structures which are of little taxonomic importance in other groups. Figure 253 is included in order to furnish the reader with a guide to the main descriptive terms employed.

The new departures in the terminology of description naturally apply mostly to the modified manus and to the membrane which unites its digits and passes variably to the hind limb and the tail. This membrane is termed the *patagium*. The patagium not only stretches between the digits of the

manus, for part of it variably fills the bend of the elbow, between the humerus and the radius: this most anterior part of the membrane is termed the *prepatagium*. Again, the membrane which stretches between the two hind limbs and variably includes the tail is known as the *uropatagium*. Each portion of the patagium has its differences of dimensions and of characters in different types of bats, and moreover every portion of it has its character markings. The description of the patagial markings is a complicated affair: and here we will be content with a figure, which shows the measured patagium of the type under examination and the principal markings which are to be seen on its surface.

The relative lengths and the characters of the digits which support the patagium are also matters of great diagnostic importance, and so are the number and condition of the joints in the separate digits, and the manner in which the last joint of the fourth digit terminates at the free edge of the patagium. The relative lengths and the condition of the digits of the pes are also important, just as they are in other mammals, and the relation of the tail to the uropatagium must always be noted. Besides the specialization evinced in the wonderful development of the patagium, the bats also display the most extraordinary elaboration in the facial sense organs. In other mammals we have noted the sensory vibrissae upon the face. In the bats these sensory vibrissae are replaced by curious expansions of the sensory skin around the nose and lips, or of the auricle or tragus of the ear. These facial sensory organs may be thin and leaflike, or they may take the form of elevations which give rise to hairs. The eyes of all species are relatively small, and probably the greatest informative sense organs are the curious sensory elaborations of the skin of various portions of the face. Just as in other mammals, the characters of the skull and teeth are of the utmost importance, and though no very detailed description is attempted here, figures of the skull and of dental peculiarities are inserted wherever possible. It is extremely likely that the small species of Australian bats have not been determined completely or even satisfactorily, and much remains to be done in the way of collecting and fully describing and illustrating our small bats, even if they appear to be common species. I have asked a correspondent if there were any bats in his district, and have received the reply that there were, but they were only the "common sort." When stimulated to collect his common sort for examination, the correspondent sent in no less than five distinct species. In the absence of a complete, or nearly complete, account or revision of the Australian bats, I have selected typical examples of definitely recognised species, and have described and figured them from spirit preserved or fresh specimens. In some cases there are details in the descriptions here given which do not fit in precisely with those recorded in such classical accounts as Dobson's Catalogue of the Bats in the Collection of the British Museum, 1878.

In these cases I assume that the discrepancies are due rather to the fact that the material here described is either fresh or recently spirit preserved and not in the form of dried skins, than to the alternative possibility that the animals are not truly specifically identical.

Although it is a simple enough matter to give descriptions and illustrations of the species obtained, it is an altogether different story when an attempt is made to give an account of the life-history, the habits, or the distribution of any bat. In Europe and in America much study has been given to these questions, and every fact established concerning the intimate details of the economy of bats is of surprising interest. Bats are the most wonderful of mammals; but of our Australian species next to nothing has been recorded. Here is a vast subject for our field naturalists. Australia may one day beget investigators like Rollinat and Trouessart, who will do for the bats of Australia what these workers did for the bats of France. In the meanwhile there is little that can be recorded of the life histories of even our commonest species.

Bats live in hollow trees, in caves and crevices, and in roofs and outhouses. They often congregate in large colonies, and very often the males and females occupy separate shelters. In Europe and North America they hibernate during the colder months, and some species of American bats undergo a periodic migration.

The whole Order Chiroptera is subdivided into two very distinct Sub-orders, the one containing the large fruit-eating species (*Megachiroptera*) and the other consisting of the small, insectivorous bats (*Microchiroptera*).

These two Sub-orders differ from each other in many very essential characters, and their exact relations to each other are not altogether clear. However, if the precise systematic relationship of the Megachiroptera to the Microchiroptera is not obvious, there can be no doubt as to the distinction between the two Sub-orders from an economic point of view. The insectivorus Microchiroptera are in every way beneficial to human enterprises, and are creatures deserving any protection that can be extended to them; whereas the fruit-eating Megachiroptera are, in the more tropical regions, a very serious threat.

Sub-order MEGACHIROPTERA.

The Fruit-eating Bats are large creatures with elongated, snouty, faces, which have earned the popular name "Flying foxes" for the Sub-order. The second digit of the manus is well developed and usually terminates in a claw. The tail is absent, except in certain aberrant forms. The molar teeth are not sharply cusped and are adapted to a vegetable diet.

The Flying foxes, though familiar enough in the northern portions of the continent, do not occur in this State, and although this may be considered as a zoological loss to South Australia, from every other point of view it is South Australia's gain. Although no Flying foxes live in

this State, several stragglers have been reported from time to time, and since the recognition of such possible pioneers is a matter of importance, Figure 254 is inserted as a guide to the characters of the group.

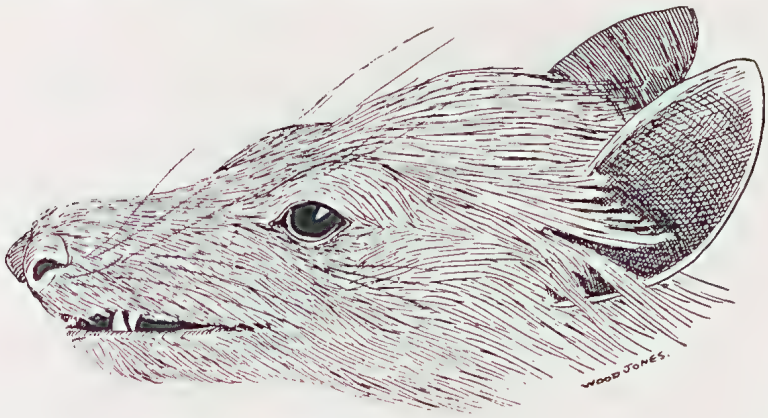

FIGURE 254.—Characters of the head of a Fruit-eating Bat. The species figured is *Pteropus gouldi* of North-eastern Australia. Natural size.

SUB-ORDER MICROCHIROPTERA.

Of the two Sub-orders comprising the Order, that of the Microchiroptera is undoubtedly the higher, for, zoologically speaking, the small insectivorous bats are far in advance of the large fruit-eating species. The most salient point by which the members of this Sub-order may be distinguished is the fact that the second digit of the modified manus is rudimentary, and never carries a claw at its extremity.

The tail is either included in the uropatagium, or becomes free upon the upper surface of the membrane. The molar teeth are sharply pointed, and are adapted for breaking up the harder parts of the insect food. The face is usually short, the muzzle being very little prominent, and in general contrast with the fruit-eating Megachiroptera, they are flat-faced, and not snouty. Often the nose is extremely complex, certain portions of its skin surface being developed into remarkable sense organs. At times the ears are also expanded into somewhat similar sensory appendages. All are comparatively small, and some are minute animals; the largest member of the Sub-order is an Australian species. The voice is uttered whilst on the wing; it is peculiarly shrill and sharp, and has the interesting quality that it is beyond the range of auditory perception of many human ears. All the Microchiroptera are nocturnal or crepuscular in their activities, and each species has, as a rule, a very definite hour at which it takes its flight.

The identification of any particular species of bat is a matter of some uncertainty if conducted by any method of casual examination. There should, however, be no difficulty in determining a specimen if attention is given to the characters enumerated in the tables for distinguishing families, genera, and species.

KEY TO THE FAMILIES OF MICROCHIROPTERA REPRESENTED IN AUSTRALIA.

(A.) Without median appendages to the nose.

(B.) Tail for a great part of its length free of the uropatagium.

(C.) Tail becoming free at the posterior margin of the uropatagium.

Family I. *Mollosidae.*

(C¹.) Tail becoming free by perforating the dorsal surface of the uropatagium.

Family II. *Emballonuridae.*

(B¹.) Tail wholly, or almost wholly, contained within the uropatagium. Family III. *Vespertilionidae.*

(A¹.) With median appendages to the nose.

(D.) Ears with a tragus. Family IV. *Megadermidae.*

(D¹.) Ears without a tragus.

(E.) All pedal digits, with the exception of the first, with three phalanges.

Family V. *Rhinolophidae.*

(E¹.) All pedal digits with two phalanges.

Family VI. *Hipposideridae.*

Family I.—MOLOSSIDAE.

The bats belonging to this family are distinguished by the fact that the tail, which is long and thick, projects far beyond the free margin of the uropatagium. The legs are short and sturdy, the feet large. The patagium is narrow, the fifth digit of the manus being short. The uropatagium is short and mobile along the length of the tail. All the membranes are

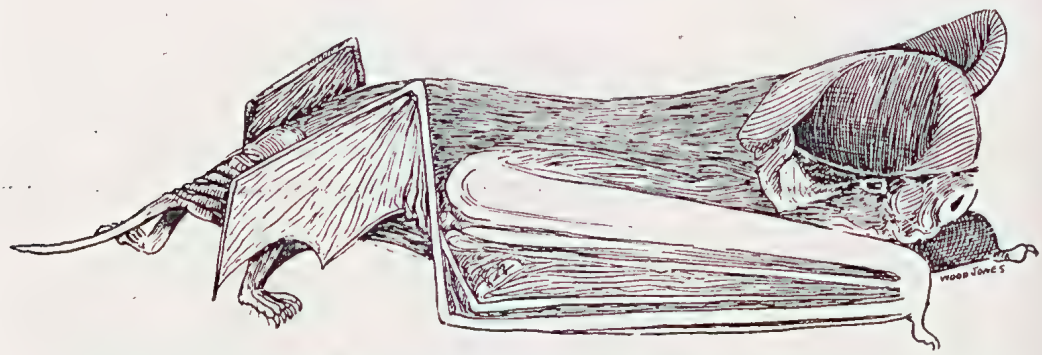

Figure 255.—A Molossine bat (*Nyctinomus australis*) in the "scurrying" position. Note the manner in which the *uropatagium* is tucked up when the animal walks or climbs. Natural size.

leathery. The ears are thick. The molossine bats are far more at home upon the ground than are the other members of the Chiroptera. Their legs and feet exhibit striking resemblances to those of ordinary tree-climbing animals; indeed, these bats show such an aptitude for climbing about the branches of trees and scurrying along the ground, that they have earned the popular name of Scurrying Bats. (*See* Figure 255.) They are well perfected for flying and are amongst the most rapid of all the Chiroptera, but they have by no means lost their ability to climb and walk. The Family is cosmopolitan in the warmer portions of both hemispheres. Two genera occur in Australia.

(A.) Palate incomplete . . . . . *Nyctinomus.*
(A¹.) Palate complete . . . . . *Chaerephon.*

Genus NYCTINOMUS (Geoffroy, 1813).

Bats belonging to this genus are distinguished by their short legs and stout feet, combined with a long leathery tail, which protrudes from the wrinkled uropatagium. The ears are approximated in the middle line by the bases of their inner margins. The tragus is short. The muzzle is broad, the rhinarium projecting considerably in advance of the lower lip. The upper lip swollen and usually crenated. The joints of the fifth digit of the manus are rigid. The membranes are thick; the patagium long and narrow. The uropatagium is corrugated and mobile along the length of the tail. The tail is thick and produced variably beyond the posterior margin of the uropatagium. Legs and feet stout and strong. The anterior portion of the palate is incomplete, the premaxillary bones being separated in front.

Dentition:—I. $\frac{1-1}{3-3}$ or $\frac{1-1}{2-2}$. C. $\frac{1-1}{1-1}$. P.M. $\frac{2-2}{2-2}$. M. $\frac{3-3}{3-3}$.

The genus is distributed all over the world in tropical and sub-tropical zones. The best popular name for the members of this group, and the one which will be employed here, is Free-tailed Bats.

Two species are found in South Australia, and these are readily distinguished as follows:—

(A.) Size large. Radius 50-65 mm. (1) *N. australis.*
(A¹.) Size small. Radius 35 mm. (2) *N. petersi.*

(1) White-striped Bat.

Nyctinomus australis (Gray, 1838).

This fine bat has been the subject of considerable confusion in nomenclature. In all works dealing with Australian zoology two species of White-striped Bat are described, the one named *Nyctinomus australis* and the other *N. albidus.* The history of these forms is as follows:—

In 1838 Gray gave a very brief description of a bat which was obtained, according to him, in New South Wales. Of this bat he had only one specimen, which was a male; the female was unknown to him. This solitary

male had a band of white fur surrounding the ventral surface and he named it *Nyctinomus australis*. In 1878, Dobson, in the British Museum Catalogue, described the male *N. australis* with the white band as Gray had done; but said that the female lacked this pure white band as she did the curious sac—the gular pouch—upon the throat. (*See* Figure 256.) In

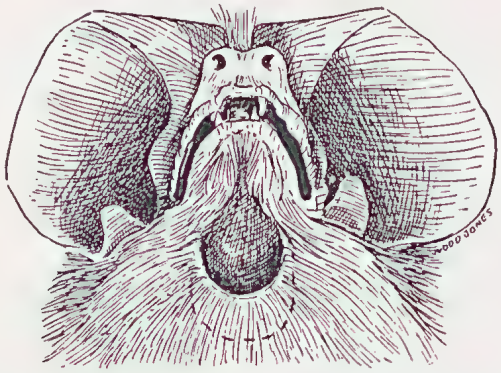

FIGURE 256.—*Nyctinomus australis*. Underside of the throat of an adult female to show the gular sac. One and a half times natural size.

1884 a single female bat was described by Leche. This bat came from South Australia, and it was like the male of *N. australis*, since it possessed both a ventral white band and a gular sac. This bat Leche named as a new species, *N. albidus*; and it must be remembered he did not examine a male specimen. It at once became obvious in searching over specimens of this

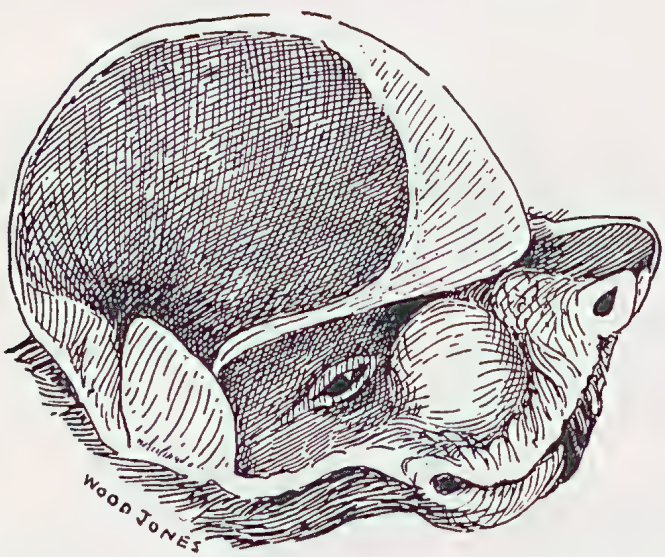

FIGURE 257.—*Nyctinomus australis*. Side face view of the head of an adult male. Three times natural size.

genus in my own collection and in that of the South Australian Museum that no bats having white bands and gular sacs in the males, but these features absent in the females, existed; in other words, it seemed certain that Gray's *N. australis* and Leche's *N. albidus* were male and female of

the same species and that Dobson's account of the female was incorrect. Troughton, working over the material in the Australian Museum in Sydney, also came to this conclusion. Oldfield Thomas has kindly re-examined the type specimens which are in the British Museum, and has concluded that "the colour characters recorded by Dobson as distinguishing the sexes prove not to be sexual at all." There is then only one species of White-striped Bat, and it is the large Free-tailed Bat, by no means uncommon in this State, in which the male and female are alike in colouration and in cranial characters and practically alike in the features of the gular sac. The characters of the species are as follows:—The large, almost leathery, ears are practically conjoined by their inner margins, which spring from a common origin 5 mm. behind the tip of the rhinarium. (*See* Figure 257.) The outer margins of the auricle are continued *via* the antitragus to the

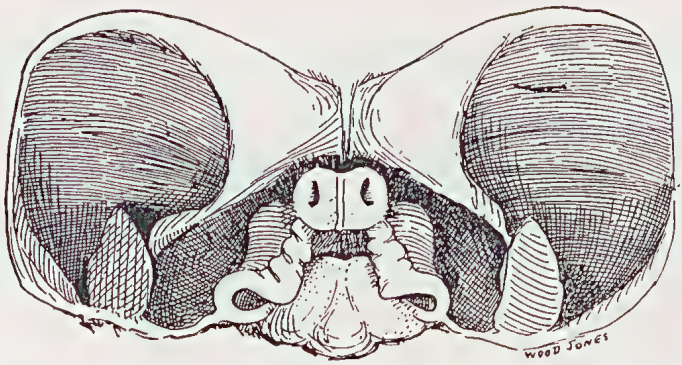

FIGURE 258.—*Nyctinomus australis*. Full face view of the head of an adult male. Twice natural size.

angle of the large mouth. The antitragus is very large and prominent; its anterior margin is convex; its posterior margin straight; its height slightly exceeds the length of its base. Tragus short and broad; its outer margin notched at its mid-point. The rhinarium is pointed, the end of the muzzle being obliquely truncated, and reminiscent of the snout of a pig. The upper lip is highly crenated, a series of some half-dozen vertical ridges springing from its raised free margin. (*See* Figure 258.) The excursion of the lips around the angle of the mouth is wide. The lower lip granulated. A well-marked elevation is situated between the small eye and the rhinarium. Cheeks almost naked. Crown of the head flattened. Beneath the chin is a mid-line elevation from which spring a few interramal vibrissae. The large gular sac alike in both sexes, save that in the male a curious hair mass occupies its cavity; its mouth measures 9 mm. across its breadth and its depth slightly exceeds this measurement. Inside the pouch of the male a remarkable structure exists; from the sides of the lining of the pouch there spring two closely packed tufts of hair which, growing into the cavity of the pouch, meet by their tips in the mid-line.

The pouch of the female is devoid of this hair mass. Patagium arising by a thickened margin from the lower third of the tibia. On the ventral surface, between the arm and the thigh, is a beautiful fringe of pure white hairs; this fringe being identical in the two sexes. Upon the dorsal surface there are developed fine brown hairs on the membrane between the lower third of the radius and the upper third of the metacarpals of the fourth and third digits. (These hairs are said by Leche to be absent in the type

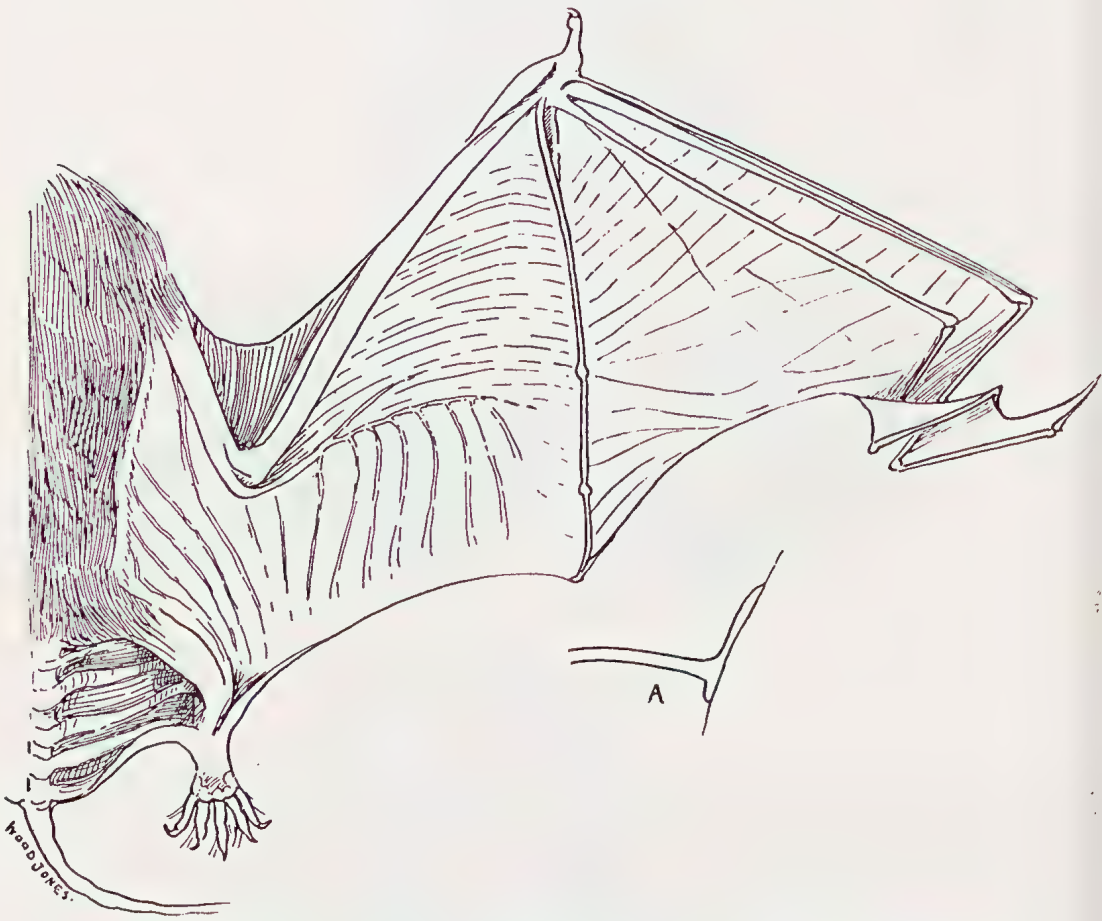

FIGURE 259.—*Nyctinomus australis*. Wing membranes, showing the main membrane markings. Natural size. A. is an enlarged view of the termination of the fourth digit.

specimen of *N. albidus*.) Hair is also continued from the sides of the body upon the dorsal surface of the patagium between the humerus and the femur. This fringe of brown hair upon the dorsal surface corresponds to the fringe of pure white hair on the ventral surface. Very fine brown hairs are also present on the upper part of the dorsal surface of the uropatagium. Dorsal surface of head and body clothed with fine velvety fur of a rich dark red-brown colour. The individual hairs are somewhat lighter at the base than at the tip, and they average 5 mm. in length. The fur of the ventral surface is paler and not so rich in colour. The marginal band is pure white in both sexes. The uropatagium is strongly

wrinkled across the tail and marked by various irregular folds, which are merely expressions of the degree of retraction or protrusion of the membrane along the length of the tail. (*See* Figure 259.) The feet and

FIGURE 260.—*Nyctinomus australis*. Lateral view of the skull of an adult female. Three times natural size.

legs are stout, the digits are strongly clawed, and their terminal phalanges give rise to stiff hairs. The first digit is slightly shorter than the others; the calcaneum is well developed.

The skull is strongly built, with a well developed brain case and a sharply

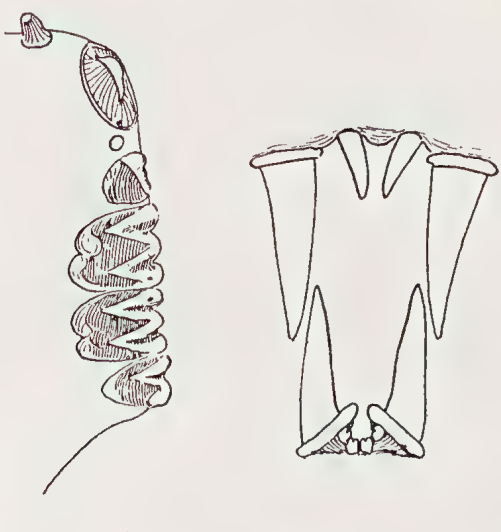

FIGURE 261.—*Nyctinomus australis*. Dentition. A. The upper tooth row of the left side. B. The front teeth of both jaws.

rising occipital crest. (*See* Figure 260.) Bullae moderately developed. Palate extending slightly behind the anterior root of the zygoma. Teeth as in Figure 261.

DIMENSIONS.

	Type of *N. albidus*, Leche. ♀	South Australian Specimens. ♀	♂
Head and Body	85	78	80
Head	30	—	—
Ear	26	25	27
Tragus	5	5	5
Humerus	—	25	25
Radius	60	61	62
Digit I.	—	9	9
Digit III.	58	61	57
	—	25	23
	—	25	23
Digit IV.	—	12	10
	—	58	54
	—	21	19
	—	18	15
Digit V.	32	34	29
	—	19	17
	—	10	9
Femur	—	15	14
Tibia	30	19	18
Foot	—	10	10
Tail	47	55	45

It seems certain that Leche's measurement of 30 mm. for the tibia must have been recorded in error.

DIMENSIONS OF SKULL.

	Adult ♀.
Length	28
Breadth	16
Constriction	5
Palate	9

This fine bat is widely distributed throughout the Southern portions of the State, and has been recorded by Waite from the arid interior. It is not uncommon in the Mount Lofty Ranges. One specimen which I was fortunate to have alive for a short while exhibited the most extraordinary activity in scurrying. It ran and climbed and insinuated itself into dark corners with the greatest rapidity. Though quite contented to run about my hands when unrestrained, it bit savagely when any attempt was made to hold it, and fought fiercely to regain its liberty when grasped.

It was particularly concerned in the toilet of its velvety fur, and continually raked its coat with its pliable and well-developed foot. It seemed probable to me (and, indeed, the suggestion was made so long ago as 1865 by Mr. Osburn with regard to a Jamaican *Nyctinomus*) that the stiff curved hairs which fringe the lateral digits increased the efficiency of the pedal brush and comb.

(1a) Black Free-tailed Bat.

NYCTINOMUS AUSTRALIS ATRATUS (Thomas, 1924).

The following is Oldfield Thomas's original description of this subspecies:—

"Fur above and below wholly black, the hairs, in marked distinction from those of *australis*, black to their bases, or, if there is any difference, the tips may even be faintly browner and paler. Lateral wing-membrane without any trace of the whitish line along the edge of the body below, the hairs of this part being equally black with the rest. Indeed, the only light coloured hairs on the whole animal are a few at the back of the femora below.

Dimensions of the type:—

Forearm 59 mm.

Head and body 91; tail 35; ear 25; third finger, metacarpal 59.

Skull: greatest length 24·3; front of canine to back of M·3, 9·2"

This fine black bat was sent to me by Mr. A. G. Bolam, who obtained it at Ooldea, and, so far, it remains the only specimen yet examined. The following measurements, taken in the flesh, supplement those contained in the original description.

Tragus	3	Digit IV.	15, 18, 15
Humerus	25	Digit V.	31, 16, 8
Radius	59	Femur	16
Digit I.	(clawless) 7	Tibia	17
Digit III.	59, 22, 23, 11	Foot	10

It is much to be hoped that more examples of *Nyctinomus* will be collected from the more arid parts of the North, and that this solitary black specimen will not remain unique.

(2) Peters' Free-tailed Bat.

NYCTINOMUS PETERSI (Leche, 1884).

This little scurrying bat was described by Leche from South Australian specimens, and it is easily distinguished from its nearest ally—*Nyctinomus norfolcensis*—of Eastern Australia and Norfolk Island by the fact that the patagium arises almost half-way up the tibia and not from the ankle as it does in the Eastern species.

From all other Australian members of its genus it is distinguished by the great length of the metacarpal bone of the fifth digit of the manus—compared with the length of that of the third.

The ears are large and are fairly thick and leathery in texture; their inner margins, which are almost straight, arise from separate points situated close together and 5 mm. behind the tip of the rhinarium. (*See*

(Figure 262.) The outer margins sweep boldly round, and are carried forward to within a millimetre of the angle of the mouth. The antitragus is represented only by a slight elevation of the outer margin; the tragus is triangular with a rounded point, its anterior margin joins the face at the

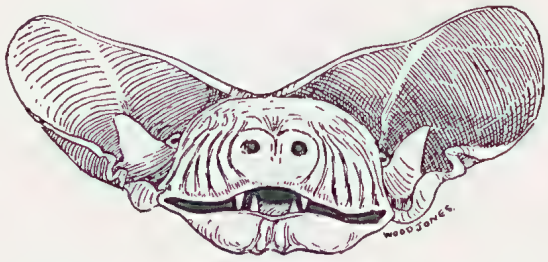

FIGURE 262.—*Nyctinomus petersi.* Full face view of the head of an adult female. Twice natural size.

posterior canthus of the eye. The muzzle is broad and expanded, obliquely truncated in front. The nostrils are widely separated and open directly forwards. The upper lip is expansive and plicated by vertical folds and wrinkles. (*See* Figure 263.) The broad lower lip falls considerably short

FIGURE 263.—*Nyctinomus petersi.* Side face view of the head. Three times natural size.

of the upper lip and shows similar, but finer, wrinkling. Face and muzzle nearly naked, not marked by definite localised swellings; the eye fairly large and bordered below by a deep horizontal groove (as in *Taphozous*). The gular sac is absent in both sexes. The patagium arises by a thickened margin just below the mid-point of the tibia. (*See* Figure 264.) The uropatagium is wrinkled across the length of the tail and is attached to a well-developed calcaneum. The feet are broad and strong, the first and fifth digits being broadened and giving rise to strong curved marginal hairs; hairs also spring from the terminal phalanges of the intermediate digits. The strong fifth digit is shorter than the rest.

General body fur short, not exceeding 3 mm. Dorsal surface pale brown, ventral surface pale fawn grey. Short hairs extend from the sides of the body to the dorsal surface of the patagium between the humerus and the

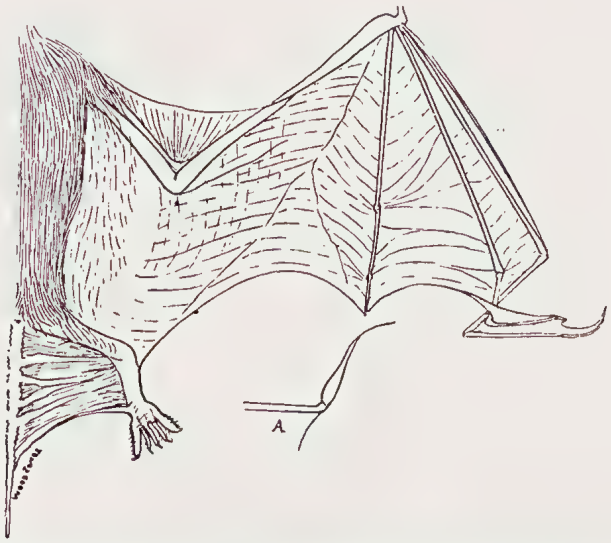

FIGURE 264.—*Nyctinomus petersi.* Wing membranes, to show the main membrane markings. Natural size. A. is an enlarged view of the termination of the fourth digit.

femur and a very sparse line of hair fringes the margin of the radius. There is also an extension of body hairs on the ventral surface of the patagium immediately adjacent to the body.

The skull is peculiarly flattened, the upper surface being practically a straight line in profile, with the occipital crest as the highest point. The

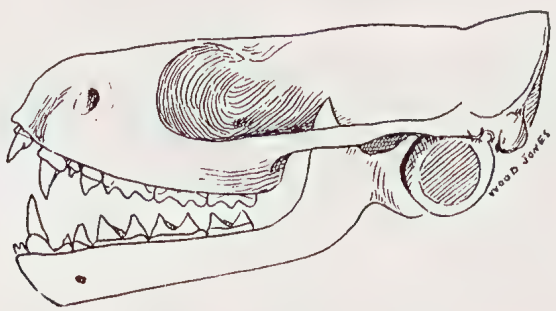

FIGURE 265.—*Nyctinomus petersi.* Lateral view of the skull of an adult female. Four times natural size.

bullae are moderate, and incomplete on their mesial aspect. (*See* Figure 265. For details of the dentition *see* Figure 266.)

This small Free-tailed Bat was originally described from a South Australian specimen, and it still appears to be a member of the fauna of

this State. Apparently it is by no means abundant, and I know no observations upon its habits or manner of life.

DIMENSIONS.

	Leche's Type. ♀	South Australian. ♀
Head and body	57	60
Ear	16	14
Humerus	—	16
Radius	34	34
Digit I.	—	4
Digit III.	36	35
	—	12
	—	11
	—	5
Digit IV.	—	32
	—	10
	—	10
Digit V.	24	23
	—	8
	—	4
Femur	—	9
Tibia	10	11
Foot	—	6
Tail	33	28

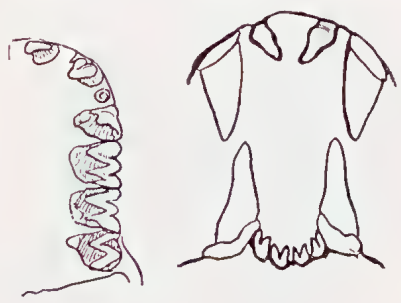

FIGURE 266.—*Nyctinomus petersi.* Dentition. A. the upper tooth row of the left side. B. the front teeth of both jaws.

DIMENSIONS OF SKULL.

Length	15
Breadth	9
Constriction	4
Palate	7

GENUS CHAEREPHON (Dobson, 1874).

The members of this genus differ from the bats included in the genus *Nyctinomus* only in the fact that their palates are complete, for the premaxillary bones meet in the middle line at their anterior extremities. Only one member of the genus inhabits Australia, and it is included in the fauna of this State.

Wrinkled-lipped Bat.

CHAEREPHON PLICATUS (Buchanan-Hamilton, 1800).

This species differs from the White-striped Bat in the absence of the white stripe and in the absence of the gular pouch in both male and female. It is a sturdily built, robust, bat, with leathery ears and membranes; with ears which are united to each other across the face, and with its large upper

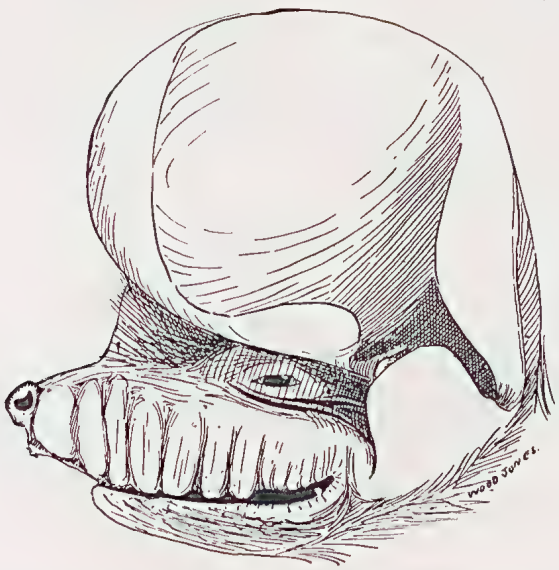

FIGURE 267.—*Chaerephon plicatus.* Characters of the head of an adult female. Three times natural size.

lip curiously wrinkled and folded. (*See* Figure 267.) The ears are large and thick, their inner margins are joined together for a space of about 5 mm. This junction of the ears stretches across the muzzle as an upright bar, situated at about one-third of the distance from the tip of the nose to the eye. Above the point of junction the inner margins rise boldly convex to the low rounded tip. The outer margin follows with a bold convexity from the tip, and, below, develops a large antitragal lobe separated behind by a sharp notch and in front joining a fold which springs from the angle of the mouth. The inner margin, below the point of its junction with its fellow of the opposite side, swings backwards above the eye as a bold internal basal lobe, which terminates above and behind the eye. The tragus is extremely small and inconspicuous, the outer margin is notched just above the base. The muzzle is in general somewhat pig-like, the large nostrils being prominent and directed forwards and outwards. The upper jaw projects considerably in advance of the lower jaw. The ample upper lip is thrown into a series of folds and marked by deep vertical grooves, its free edge being scalloped in harmony with the foldings. The eye is rather small; the eyelids are prominent and the lower lid is separated from the swollen upper lip by a groove. The naked portion

of the chin is also wrinkled by a series of longitudinal folds and the posterior portion of the lower lip is puckered. The head is flat, the forehead, behind the bar joining the ears, being depressed.

There is no gular sac in either sex. The patagium is typically long and narrow. The legs and feet are sturdy. The first digit of the pes is enlarged and is fringed with stiff recurved hairs, the fifth digit is similarly fringed. The patagium arises from the lower end of the tibia. The fur is soft and velvety. The only specimens available for examination have long been preserved in spirit, and in them the dorsal fur is warm brown at the tips and paler at the roots, and the ventral fur is buff brown. In living animals the colour is said to be smoke black above and paler on the ventral surface. The uropatagium is leathery and wrinkled. The tail thick, quite naked, and marked by a series of rings.

DIMENSIONS.

	Adult ♀
Head and body	74
Ear	23
Tragus	1·5
Humerus	25
Radius	52
Digit I.	7
Digit III.	48·5
	21·5
	21
	9
Digit IV.	45
	16
	15
Digit V.	27
	14·5
	7
Femur	15
Tibia	17
Foot	8·5
Tail	41

The skull is strongly ridged by a single crest in the middle line; this crest rises to a maximum somewhat behind the mid-point in the length of the skull and fades away upon the muzzle. (*See* Figure 268.) The brain case is well rounded. The angles of the lower jaw are strongly everted. The first upper premolar is a minute tooth. The lower incisors are much reduced, and only one is present upon each side in the specimens examined.

DIMENSIONS OF SKULL.

	Adult ♀
Length	20
Breadth	13
Interorbital constriction	4·5
Palate	8·5

This bat appears to be rare in South Australia and to be confined to the northern parts of the State. It is rather remarkable that all the specimens in the State Museum were received many years ago, and there seem to be no recent records of its capture in South Australia.

This Australian species has usually been considered as identical with the Indian bat to which the name *C. plicatus* was originally given. When examining representatives of this species from Northern Territory, Oldfield Thomas decided that the Australian animal deserved sub-specific rank, and he named it *C. plicatus colonicus*. It is extremely probable that the comparison of a good series of the Indian and Australian forms would reveal the fact that the Australian bat is distinct, and should, therefore, be known by its own specific name, *C. colonicus*.

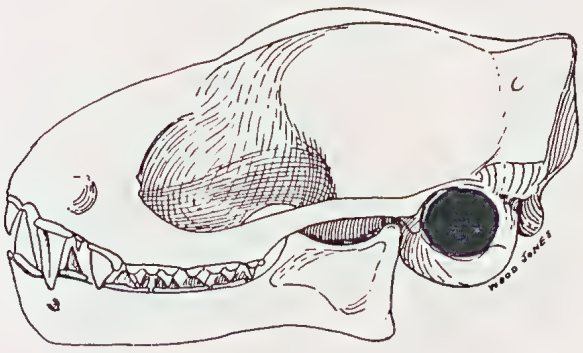

FIGURE 268.—*Chaerephon plicatus*. Lateral view of the skull of an adult female. Three times natural size.

FAMILY II.—EMBALLONURIDAE.

Within this family is embraced a large number of somewhat primitive bats which range over the more tropical portions of the whole world. The tail is rather long and slender and is peculiar in that it becomes free of the uropatagium by piercing its dorsal surface. For this reason members of the family are often known as Sheath-tailed Bats. They are further distinguished by having slender legs and narrow feet, a reduced second digit of the manus, and by the fact that the basal phalanx of the third digit of the manus is bent backwards. They are strong animals with thick membranes, and, like the Molossine bats, are well able to climb and run about the walls of the caves which they usually inhabit.

Only one genus is represented in the fauna of Australia.

GENUS TAPHOZOUS (Geoffroy, 1812).

The Australian members of this genus are easily recognised by the fact that the tail perforates the uropatagium and appears upon its upper surface.

The muzzle is elongated and conical, tapering towards the rhinarium; the nostrils are valvular. The crown of the head is only slightly raised above the level of the face, and there is a well-marked depression between the eyes. The ears are separate; their inner margins arise by a short band from the side of the depression between the eyes; the outer margins take origin from a small lobe below the angle of the mouth. The tragus is short, narrow below and expanded above. The lower lip is marked in the middle line in front by a groove which separates two small triangular naked areas. The eyes are rather large; there is a well-marked horizontal groove below them. The first digit of the manus has a small but sharp claw. The first phalanx of the third digit of the manus is folded backwards on to the dorsal surface of the metacarpal when the patagium is not spread for flight. The uropatagium is movable on the tail. The feet are long and slender, the lateral digits not fringed with hair. Dentition:— I.$\frac{1-1}{2-2}$. C $\frac{1-1}{1-1}$. P.M.$\frac{2-2}{2-2}$. M. $\frac{3-3}{3-3}$. The anterior part of the palate (premaxilla) is composed of cartilage, and the incisors, which are rooted in it, are small and weak teeth which are often absent in adult animals. The genus ranges from Egypt to New Guinea and four species inhabit Australia, three having been recorded from this State, but one of them probably in error. The remaining two species are easily distinguished as follows:—

(A.) Size large; radius measuring 70-80 mm. Ventral surface white.

(1) *T. flaviventris.*

(A^1.) Size smaller; radius measuring 60-70 mm. Ventral surface brown.

(2) *T. georgianus.*

(1) Yellow-bellied Bat.

Taphozous flaviventris (Peters, 1866).

This fine bat is sometimes placed in a separate genus—*Saccolaimus* (Temminck, 1841)—but the distinctions upon which this genus is founded appear to me to be so slender that I have not followed the latest work (by Troughton, of Sydney) on this group in separating *flaviventris* generically from *australis* and *georgianus.*

The Yellow-bellied Bat is a large species with the dorsal surface variably coloured black or brown and the ventral surface pure white, creamy, or yellowish.

The head is large, the muzzle elongated, and the whole form sturdy and robust. The ears are large and are of a generally even oval outline and thick and leathery in texture. The inner margin arises from the forehead above the eye; it is evenly convex below, somewhat flattened above, and rounded off at the tip. (*See* Figure 269.) The outer margin is flattened

below the tip, then evenly convex; thickened and notched below the tragus and distinctly lobed before its termination behind the angle of the mouth. The tragus is concave along its inner margin; convex along its free margin, and deeply notched on its outer margin. The nostrils face almost directly forwards, a slight groove separating their inner margins. The lower lip is grooved in the mid-line, and upon each side of the groove is a smooth, flattened ridge. The gular pouch is well developed in the male but absent in the female. In the male the pouch measures 12 mm. across the mouth, and midway along its free margin is a small secondary pocket of which the mouth measures 1.5 mm. The crown of the head is flattened and concave between the eyes. The muzzle is almost naked, the hair of the forehead commencing over the site of the frontal depression. The fur of

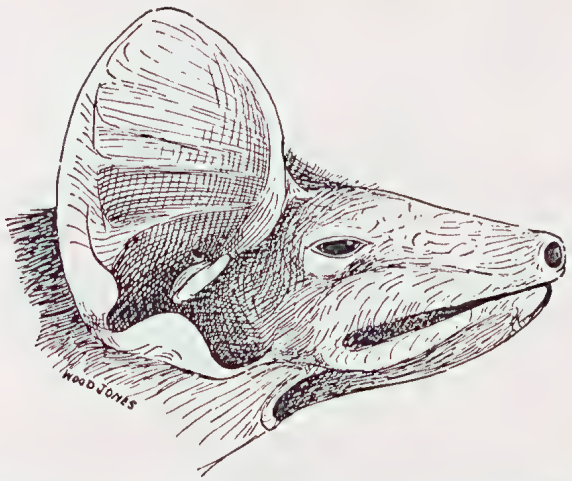

FIGURE 269.—*Taphozous flaviventris.* Side face view of the head of an adult male. Twice natural size.

the dorsal surface of the body extends slightly outwards on to the patagium. On the ventral surface there is a considerable margin of hair on the membrane. The individual hairs of the mid-dorsal region are some 7 mm. in length, and they vary considerably in colour in different specimens. In all cases the hairs are paler at the roots than at the tips. In some specimens they are almost creamy at the base and rather bright brown over the rest of the shaft, with the actual tips darker, and in others they are dusky at the base, dark brown over the shafts, and black at the tips. The hair of the ventral surface varies from pure white to buffy and yellowish.

The pes is large and strong, the first digit being the shortest, with the fourth but little longer. The free portion of the tail is beset with sparse stiffish hairs. The patagium arises from the ankle, and all the membranes are thick and leathery. In colour they vary from warm brown to black. The radiocarpal pouch is not developed.

DIMENSIONS.

	Brown Backed. ♂	Black Backed. ♀
Head and body	100	95
Head	32	31
Ear	22	21
Tragus	5	5
Humerus	37	38
Radius	76	79
Digit I.	8	8
Digit III.	72	73
	32	34
	34·5	36
Digit IV.	54	56·5
	17·5	20
	6	7·5
Digit V.	43	47
	15·5	17
	8·5	9·5
Femur	21·5	24
Tibia	28	30
Foot	13	13
Tail	23	25

The skull is stoutly built and strongly ridged. The frontal concavity is not so well marked as it is in the smaller skull of *T. georgianus.* (*See* Figure 270.) The teeth are large; the first upper premolar is relatively large, being about half the size of the second premolar. (*See* Figure 271.)

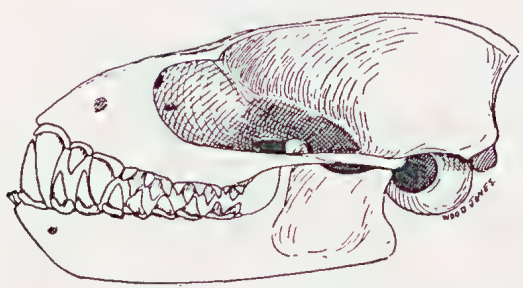

FIGURE 270.—*Taphozous flaviventris.* Lateral view of the skull of an adult male. Twice natural size.

DIMENSIONS OF SKULL.

Length	25
Breadth	17·5
Interorbital constriction	6
Palate	11

The original specimen, described by Peters in 1866, was sent by Waterhouse to Gould and by Gould was submitted to Peters. The specimen came from the South Australian Institute Museum. To this collection it was subsequently returned by Gould, and in 1871 Waterhouse forwarded it to the Australian Museum, Sydney, as part of an exchange. The specimen

remains in that Institution, and it has recently been re-examined by Mr. Troughton. The original example of this species is, therefore, a South Australian one, though it now forms part of the collection lodged in the Museum in Sydney.

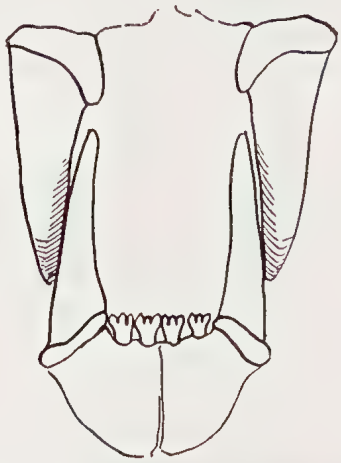

FIGURE 271.—*Taphozous flaviventris.* Anterior teeth of both jaws.

By some curious mischance, subsequent specimens arriving at the South Australian Museum were not recognised as belonging to the same species as the specimen sent to Sydney, and were designated *Taphozous australis.* The bat is a rare one and is a distinctly northern form.

Specimens in the State Museum have been received from Gladstone, Penfield, and the far North.

Sharp-nosed Bat.

TAPHOZOUS AUSTRALIS (Gould, 1853).

A brief description of this bat is given here, not because the writer believes it to be a member of the South Australian fauna, but because (1) this specific name has in the literature embraced two distinct species—(a) *Taphozous australis* (Gould) and (b) *Taphozous georgianus* (Thomas); (2) this specific name has, in the collections displayed to the public in the State Museum, been applied to *Taphozous flaviventris* (Peters). The description and measurements here given are taken from Mr. Troughton's recent monograph on the genus.

This bat resembles *Taphozous georgianus* in a general way, but may be distinguished from it by the following characteristics. The gular sac is present in the male, while in the female, although no pouch is present, its site is marked by a naked area and the presence of a rudimentary edge of the pouch. The length of the radius varies from 61.5 to 66 mm.; the tibia is from 22.8 to 24.5 mm.; it is, therefore, considerably smaller than *T. georgianus.* The original specimens described by Gould were captured in "the maritime caves in the sandstone cliffs of Albany Island, Cape York"; and apparently the true *T. australis* is confined to this district, to northern Queensland, and to New Guinea. Its inclusion in the fauna of this State is probably due to error.

(2) Western Sharp-nosed Bat.

TAPHOZOUS GEORGIANUS (Thomas, 1915).

This species is larger than *T. australis* and it lacks a gular pouch in both sexes. The ears are large, being about as long as the head. They are thick and leathery in texture at the base, thinner, almost membranous at the tip. The inner margins are widely separated on the forehead, for they take origin from either side of the deep frontal pit, which is situated between the eyes. Along the inner margin is a series of little rounded tubercles giving the edge of the ear a slightly beaded appearance. The tragus is large and spatulate, its upper margin showing a tendency to be slightly notched. The frontal pit is circular in outline, 6 mm. in diameter and 4 mm. deep at its hinder margin. The face is only slightly hairy. The upper lip is swollen and glandular, a deep cleft separating the swollen hinder end of the upper lip from the lower eyelid. The nostrils are roughly circular in outline and terminal in position; their inner margins are well

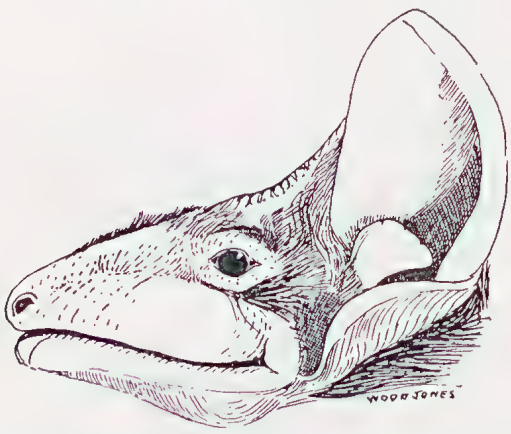

FIGURE 272.—*Taphozous georgianus.* Side face view of the head of an adult female. Twice natural size.

defined. (*See* Figure 272.) The ventral surface of the chin is swollen and only slightly hairy. The lower lip is marked by two naked elevated areas which bound the depression in the middle line. The whole muzzle is elongated and the lower jaw prominent. The gular sac is absent in both sexes. The patagium arises from the ankle, and in general form is elongated and narrow, the terminal portion of the third digit being bent backwards in the normal position of rest. (*See* Figure 273.) The whole of the membranes dull brown in colour. The uropatagium is leathery and wrinkled; its free margin is bent forwards from the point where it is perforated by the tail. The tail itself is thick where it is enclosed within the uropatagium, but extremely slender after it has perforated the membrane and become free on its dorsal surface. Three vertebrae are included in this free portion of the tail. A well-developed radio-metacarpal pouch is present between the ventral surface of the terminal portion of the radius and the base of the metacarpal bone of the fifth

digit. This pouch is made complete by a crescent-shaped membrane stretching between these two bones, ventral to the plane of the patagium. The terminal phalanx of the fourth digit is slightly expanded at its extremity into a small, flattened, ovoid enlargement.

The hair of the dorsal surface is extended some way laterally on to the wing membranes, and clothes the uropatagium as far down as the point of

FIGURE 273.—*Taphozous georgianus.* Wing membranes to show the main membrane markings. Half natural size. A is an enlarged view of the termination of the fourth digit.

perforation by the tail. The first digit of the manus, though slender, is well developed, and it carries a sharp curved claw. The legs are comparatively slender. The pes is long and narrow. The middle digit is the longest of the series, and the outer (first) digit lacks the middle joint which is present in the others.

FIGURE 274.—*Taphozous georgianus.* Lateral view of the skull of an adult female. Three times natural size.

The fur of the whole of the dorsal surface is a warm red brown; that of the dorsal surface of the body, the head, and the whole of the face uniform in colour. The fur is fine and soft, the individual hairs being some 6 mm. in length over the mid-dorsal region. At the base, the

hairs are cream or white in colour; in the greater part of their length they are warm red brown, the tips being somewhat lighter than the shafts. The ventral surface is more sombre coloured than the dorsal surface, the hairs being cream at the base and pale brown in the remainder of their length, the warm red brown hue of the tips being lacking.

DIMENSIONS.

	Adult ♀
Head and body	82
Head	28
Ear	25
Tragus	5·5
Humerus	34
Radius	69
Digit I.	9·5
Digit III.	60
	20
	25
Digit IV.	46
	14
	10
Digit V.	37
	14
	9
Femur	20
Tibia	26
Foot	10
Tail	27

The brain case is rounded and ample. The lower jaw is protruding and the teeth are relatively very large. (*See* Figure 275.)

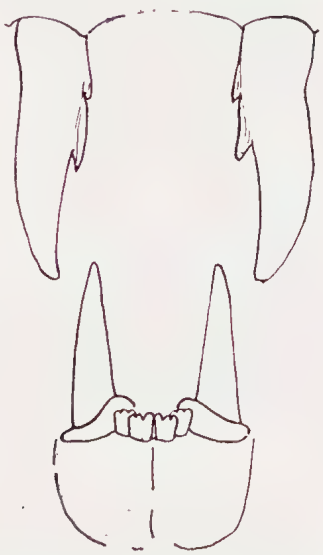

FIGURE 275.—*Taphozous georgianus.* Anterior teeth of an adult female. The upper incisors are absent as is usual in adults.

The skull is remarkable in its general form, the deep frontal pit between the orbits producing a curious expansion of the muzzle. (*See* Figure 274.)

DIMENSIONS OF SKULL.

	Adult ♀
Length	20·5
Breadth	13·5
Interorbital constriction	4·5
Palate length	8·5

The Western Sharp-nosed Bat does not appear to be common in this State; the specimen of which the measurements are recorded was captured at Ooldea, and is the only South Australian example with which I am acquainted. The type specimen was obtained from King George's Sound, Western Australia, and was described by Thomas as a sub-species of *T. australis*. Recently (April, 1925) Troughton has examined further specimens from Western Australia, Northern Territory, and Queensland, and has very rightly given the form specific rank. It is here recorded from this State for the first time.

Family III.—VESPERTILIONIDAE.

Members of this large family are distinguished by possessing simple muzzles and lips, combined with elongated tails almost wholly enclosed within the uropatagium. There are only two bony phalanges in the third digit of the manus. The tragus of the ear is well developed and elongated; the wing membranes are thin and ample. So large a number of somewhat diverse genera are included in the family that it is necessary to create smaller Sub-families which (as far as Australian representation is concerned) are distinguished as follows:—

(A.) Muzzle normal.
(B.) Sternum (breast bone) normal.
Sub-family I. *Vespertilioninae.*

(B¹.) Sternum enlarged in front.
Sub-family II. *Miniopterinae.*

(B¹¹.) Sternum greatly shortened.
Sub-family III. *Kerivoulinae.*

(A¹.) Muzzle truncated.
Sub-family IV. *Nyctophilinae.*

Sub-family I.—VESPERTILIONINAE.

This Sub-family constitutes what may be termed the normal section of the Family and six genera, out of a total of over thirty, are represented in Australia. These genera are distinguished as follows:—

(A.) Cheek teeth $\frac{6-6}{6-6}$ Genus 1. *Myotis.*
(A¹.) Cheek teeth less than $\frac{6-6}{6-6}$

(B.) Upper premolars 2-2.
(C.) Brain case normal.
(D.) Upper lateral incisor normal in position. Genus 2. *Pipistrellus.*
(D¹.) Upper lateral incisor displaced laterally from its normal position. Genus 3. *Glischropus.*
(C¹.) Brain case conspicuously deepened. Genus 4. *Chalinolobus.*
(B¹.) Upper premolars 1-1.
(E.) Upper incisors 2-2. Genus 5. *Eptesicus.*
(E¹.) Upper incisors 1-1. Genus 6. *Scoteinus.*

Genus 1.—MYOTIS (Kaup, 1829).

This, the most primitive genus of the *Vespertilionidae*, contains over eighty species. These numerous species are characterized by the possession of six cheek teeth, the whole dentition containing the maximum number of teeth known in the Order. The dental formula is as follows:—I. $\frac{2}{3}\ \frac{2}{3}$. C. $\frac{1-1}{1-1}$. P.M. $\frac{3-3}{3-3}$. M. $\frac{3-3}{3-3}$.

Combined with this full set of teeth there is a minimum of specializations of external form. The muzzle is elongated and not ornamented by any well-developed glandular elevations or skin folds. The ear is well developed, oval, and elongated in form and thin in texture.

The internal basal lobe of the auricle is triangular in form. The tragus is elongated and slender and is nearly, or quite, straight. The nostrils are crescentic and simple. The limbs are slender; the membranes thin and delicate. The pes is variable in size, but not peculiar in form. The tail is about equal in length to the outstretched leg.

Members of this genus range over the temperate and tropical regions of the whole world. Two species occur in Australia; but one only has been recorded from this State.

These two species are so unlike that no detailed scheme is needed for their separation.

(A.) Foot 10 mm. long. (1) *M. adversus.*
(A¹.) Foot 5 mm. long. (2) *M. australis.*

(1) Large-footed Bat.

Myotis adversus (Horsfield, 1824).

This species is readily identified by the form of the ear, the great length of the calcaneum, and the relatively large size of the foot. The face is elongated and unadorned by any marked elevations. (*See* Figure 276.) The nostrils are rather widely separated, directed laterally, and crescentic

in outline. The muzzle immediately behind the nostrils is naked, and upon either side of the naked area are two slight glandular pads giving rise to the pale, short mysticial vibrissae. Behind the muzzle, the forehead is depressed, but freely covered with hair, the lips and the region around the eye being the only parts of the face which are comparatively naked. The

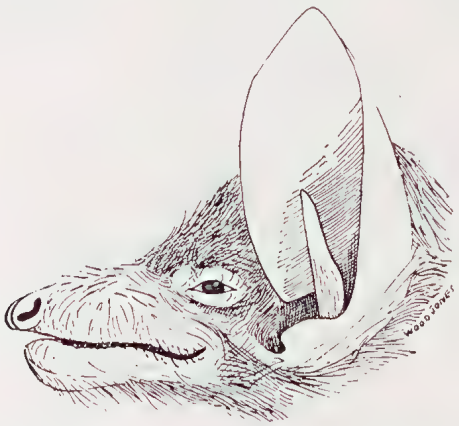

FIGURE 276.—*Myotis adversus.* Characters of the head of an adult female. Three times natural size.

ears are long, upright, and thin in texture. The inner margin of the auricle has a well marked angular basal lobule, situated directly behind the eye. Above the basal lobule, the inner margin rises slightly convex for two-thirds of its length, its upper third is straight, the straight portion joining the curved portion at a slight angle. The tip of the ear is again flattened so that its outline is roughly triangular. The superior portion of the outer margin is straight; the lower portion is slightly convex; it terminates almost immediately below the inner margin after having given

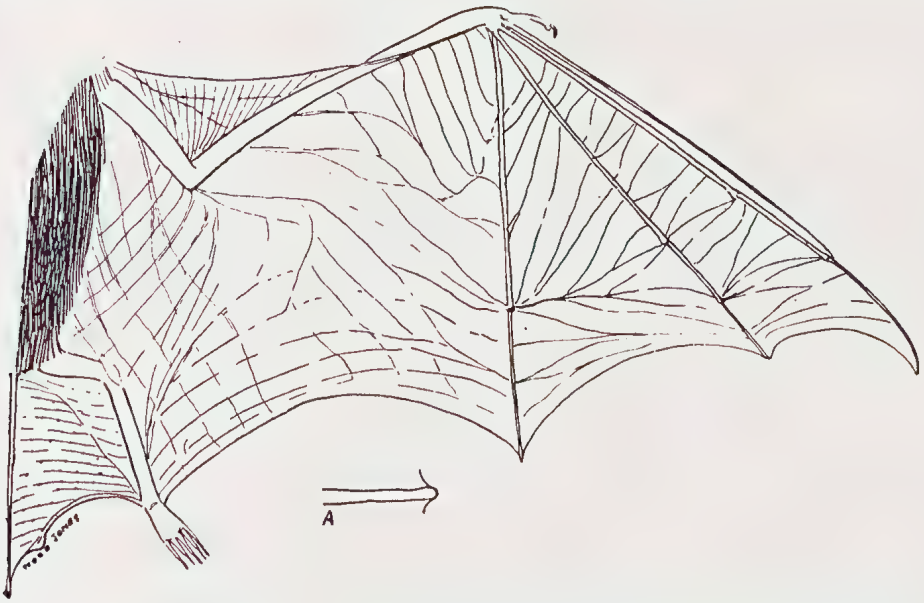

FIGURE 277.—*Myotis adversus.* Wing membranes to show the main membrane markings. Natural size. A is an enlarged view of the termination of the fourth digit.

rise to a small lobule in front of the tragus. The tragus is long and narrow; its inner margin is quite straight, the outer margin slightly convex and terminating below in a bold curve. The membranes arise from the ankles. (*See* Figure 277.) The calcaneum is extremely long and extends for more than three-quarters of the hinder margin of the uropatagium. The feet are relatively large, though they are not stoutly built. The digital formula is $4 > 5 > 3 > 2 > 1$. The limbs are slender, the tail slightly shorter than the head and body. The membranes are thin and delicate. The fur of both dorsal and ventral surfaces is a rather bright brown, the hairs being dark brown at the base and paler at the tips. On the ventral surface the pale tips of the hairs are longer and the whole pelage in consequence somewhat lighter, this being especially marked over the lower abdominal area. The hairs below the chin are pale in almost the whole of their length, and the vibrissae are practically white.

FIGURE 278.—*Myotis adversus*. Lateral view of the skull of an adult female. Four times natural size.

DIMENSIONS.

	Adult ♀ from the Murray.
Head and body	64
Ear	15
Tragus	6
Humerus	20
Radius	39
Digit I.	6·5
Digit III.	37
	15
	14
	7
Digit IV.	35
	10
	12
Digit V.	34
	9
	10
Femur	12
Tibia	17
Foot	10
Tail	35

The skull is devoid of any eccentricities of form. The brain case is well elevated above the muzzle and is ample and rounded. The whole skull is light and delicate in build and the teeth are small. (*See* Figure 278.) The second upper premolar tooth is minute and is displaced from the tooth-line towards the palate so that it is invisible from without. The second lower premolar, though standing in the tooth row, is almost equally minute.

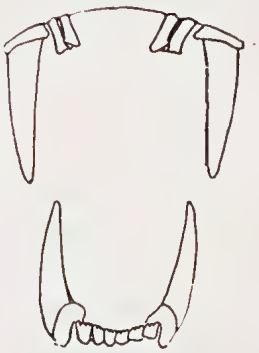

FIGURE 279.—Anterior teeth of *Myotis adversus*.

DIMENSIONS OF SKULL.

	Adult ♀
Length	15·5
Breadth	10
Interorbital constriction	4
Palate length	8

This bat is evidently very rare in this State. Its range extends from Siam through the Malayan Islands to Northern Australia.

A specimen of Gould's taken in South Australia is in the British Museum and another, the specimen here dealt with, comes from the River Murray, in South Australia. Nothing has been recorded in Australia concerning its habits.

(2) Small-footed Bat.

MYOTIS AUSTRALIS (Dobson, 1878).

This species has not been recorded from South Australia and no specimen exists in the South Australian Museum. It appears to be confined to the North-eastern part of Australia.

GENUS 2.—PIPISTRELLUS (Kaup, 1829).

The genus *Pipistrellus* contains some forty species. These bats are distinguished by their enlarged lateral incisors, which are normal in position, and by their unmodified skulls and ears. All the species are small. The dental formula is:—I. $\frac{2-2}{3\ 3}$. C. $\frac{1\ 1}{1-1}$. P.M. $\frac{2}{3-3}$. $\frac{2}{3-3}$. M. $\frac{3-3}{3-3}$.

Although having so many members, the genus is very poorly represented in Australia, only two species having been recorded. Of these, one,

P. abramus (Temminck, 1835), is an oriental species, and extends its range to the North of Australia. The other, *P. regulus* (Thomas, 1906), was described from specimens from Western Australia. No member of the genus has yet been recorded from this State.

Genus 3.—GLISCHROPUS (Dobson, 1875).

Only three species are included in the genus, which is characterized by the curious outward displacement and rotation of the upper lateral incisors.

One species, *G. tasmaniensis* (Gray, 1843), often termed Krefft's Bat, is a very rare form on the mainland, and has been recorded from New South Wales and Western Australia, but not from this State. In Tasmania the species appears to be common, and I have recently seen a series of over thirty living specimens taken from a hollow tree near Hobart.

Genus 4.—CHALINOLOBUS (Peters, 1866).

The small, short-furred bats belonging to this genus are distinguished by the possession of a wattle-like lobe which projects from near the angle of the mouth. So characteristic is this lobe, that in giving popular names to members of the genus, it is well to term them the "Wattled Bats."

The muzzle is short and broad and provided with well-developed and glandular elevations. The nostrils are prominent and the rhinarium is separated from the glandular elevations of the muzzle by a well-marked groove. The ears are short and broad, their outer margins arising from the angle of the mouth. The patagium arises from the base of the toes; the tail is long and is wholly contained within the uropatagium. The brain case is peculiarly elevated in harmony with the short, broad head which characterises the genus.

Dentition:—I. $\frac{2-2}{3-3}$. C. $\frac{1-1}{1\ 1}$. P.M. $\frac{2-2}{2-2}$. M. $\frac{3\ 3}{3-3}$.

The medial incisors are single cusped; the lateral incisors are extremely small.

The genus is confined to Australia, Tasmania, and New Zealand.

Three members of this genus are recognised as inhabiting Continental Australia and two of them are included in the fauna of South Australia.

KEY TO THE SPECIES.

(A.) The inner margin of the ear without an internal basal lobule. Radius 36 mm.
(1) *Ch. morio.*

(A^1.) The inner margin of the ear forming a definite basal lobule.

(B.) Outer margin of the ear terminating in a pendant lobule. Radius 44 mm. (2) *Ch. gouldi.*

(B^1.) Outer margin of the ear terminating in a horizontal lobule. Radius 33 mm. (3) *Ch. nigrogriseus.*

Of these species, *Ch. nigrogriseus* (Gould, 1863), which in general characters and colouration is very similar to *Ch. gouldi,* is a northern and eastern form, which has, so far, not been recorded from South Australia.

(1) Chocolate Wattled Bat.

CHALINOLOBUS MORIO (Gray, 1841).

The Chocolate Bat is a small species, in many ways resembling a small example of Gould's Wattled Bat, but lacking the internal basal lobe of the ear and the conspicuous vertical skin tag at the angle of the mouth.

In many works dealing with Australian zoology this bat is described under the name *Chalinolobus tuberculatus* (Forster), which is, however, a synonym of the older name *Ch. morio* (Gray). Again, two species are often described, the one *Ch. tuberculatus* or *Ch. morio* and the other *Ch. signifer* (Dobson). This last species is said to differ from the typical *Ch. morio* by the presence of a cutaneous elevation on the muzzle in front of the eyes. It is most likely, as has been previously pointed out by Oldfield Thomas, that this cutaneous elevation is present in all adult

FIGURE 280.—*Chalinolobus morio.* The characters of the head of an adult male. Four times natural size.

examples of *Ch. morio,* the lack of the elevation being only a sign of immaturity. The type specimens from which Gray described *Ch. morio* came from South Australia, and all examples that I have examined from this State possess an elevation on the muzzle in some degree of development. Since in the dried skin the elevation is apt to be obliterated, or hidden by the velvety hair of the face, I imagine it might be easily overlooked, and I, therefore, assume that *Ch. signifer* is a synonym of *Ch. morio;* Dobson having described as *signifer* a specimen on which the elevation, overlooked in Gray's original description of *morio,* was particularly well marked. On any other supposition it is difficult to account for the fact that in the State from which *Ch. morio* was described all the representatives, when carefully examined, are found to conform to the type of *Ch. signifer.* The head is flat, the crown being but little raised above the line of the face. (*See* Figure 280.) The glandular prominences are not very conspicuous, although the muzzle is somewhat swollen upon either side, and the ample skin fold

encircling the angle of the mouth is somewhat thickened. The nostrils are inflected from above and are directed laterally and somewhat downwards. They are rather widely separated in the middle line, where a groove divides the nasal tubes of the two sides.

The ears are small, the tips being but little elevated above the hairs of the head. The auricle is somewhat flattened and is not markedly tubular; the inner margin is strongly convex forwards at its base, but it is not extended backwards as an internal basal lobule. The outer margin is straight above, convex below, and, opposite the tragus, is lobed. The lower extremity of the outer margin terminates in a fold which is attached to a

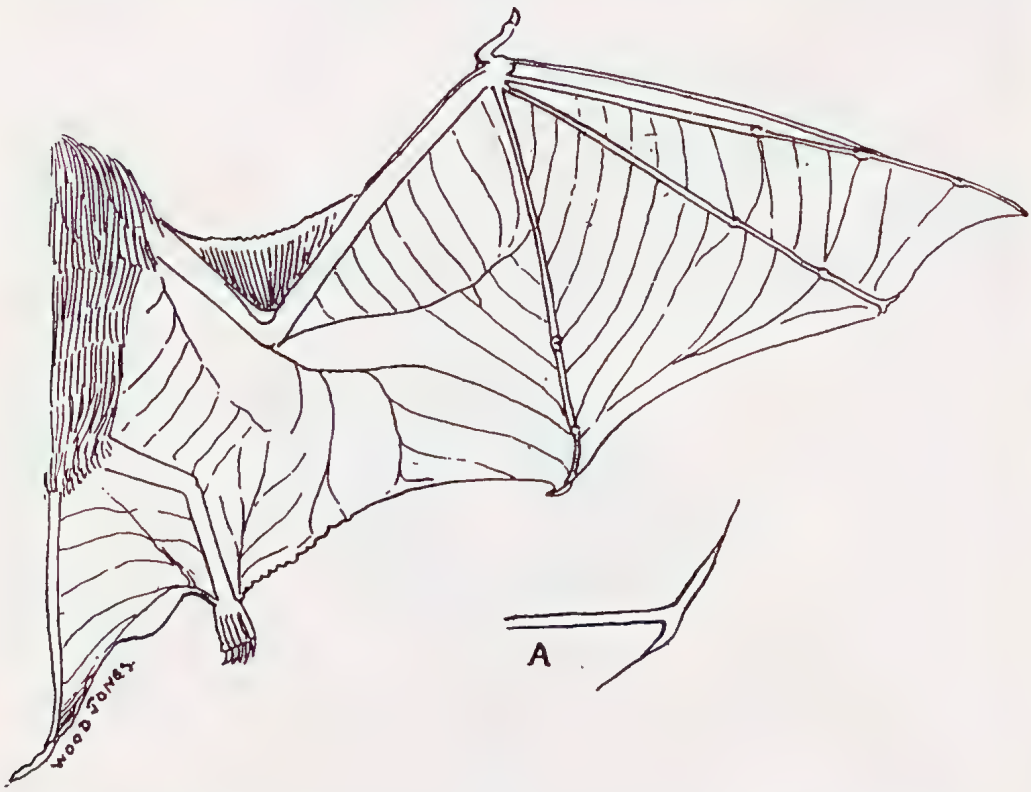

FIGURE 281.—*Chalinolobus morio*. Outline of the membranes showing the main membrane markings. Natural size. A is an enlarged view of the termination of the fourth digit.

small tubercle just behind the ample fold encircling the angle of the mouth. The tragus is large and broad in its upper portion; the inner margin is concave, the outer margin convex and lobed at its base. The muzzle is freely covered with hair, a well-marked moustache being present. The lower lip is clothed with hair, and the tubercle at the angle of the mouth gives rise to a well-marked tuft of hairs. The sides of the face around and below the eye are, however, quite naked. On the dorsal surface of the muzzle, between and in front of the eyes, is a somewhat variable transverse elevation, which stretches, with a convex upper margin, completely across the muzzle. This little ridge is the one on the presence of which Dobson founded the species *Ch. signifer* (1876).

The membranes arise from the base of the toes. The calcaneum is strong and the post calcaneal lobe well developed. (*See* Figure 281.) The tail is wholly contained within the uropatagium.

In general colour the average example of *Ch. morio* is dark rusty, and there is no well-marked differentiation of the colour of the anterior and posterior portions of the body. The fur of the head and the whole of the dorsal surface dark rusty brown at the tips. According to Dobson, whose account has been commonly copied in Australian books, all the hairs of ventral and dorsal surface are of the same colour from base to tip. Such a description is true, in the specimens that I have examined, only for the hairs of the forehead, which are brown throughout; in all other parts of the body the hairs are conspicuously darkened at the roots. On the dorsal surface of the body the hairs are dark smoky, almost black, at the base above the root of the tail. On the ventral surface the hairs are dark smoky

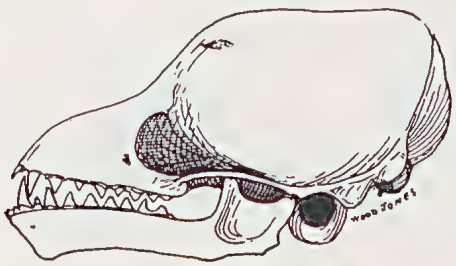

FIGURE 282.—*Chalinolobus morio.* Lateral view of the skull of an adult male. Four times natural size.

at the base and brown at the tips under the chin, and grey at the tips over the thorax and abdomen. The legs and feet are slender; the first digit of the pes is the shortest, the remaining four being almost equal in length.

DIMENSIONS.

	Adult ♂, Adelaide.
Head and body	49
Ear	7
Tragus	3·5
Humerus	17
Radius	36
Digit I.	4
Digit III.	32·5
	12·5
	12
	7·5
Digit IV.	32
	11
	11
	29
Digit V.	10
	7
Femur	8
Tibia	15·5
Pes	6
Tail	39

The skull has the remarkable elevation of the brain case which is characteristic of the genus. Relative to the facial portion of the skull the development of the great rounded brain case is enormous, and it exceeds even that seen in *Ch. gouldi*. Another very striking feature is the great size of the foramen magnum through which the spinal cord passes from the brain. The general appearance of the skull can only be described as foetal. (*See* Figure 282.)

DIMENSIONS OF SKULL.

	Adult ♂.
Length	11
Breadth	8·5
Interorbital constriction	4·5
Palate	5

This little bat is decidedly rare in South Australia. It lives about Adelaide, and is usually captured after it has come into a house in search of the insects attracted by the lights.

It is poorly represented in the collections in Australian Museums, and, save for its accidental capture, we know nothing of its habits or even of its natural haunts. It is a great pity that people who knock down bats when they are found flitting round the verandah or in a room regard them as "the common sort" and do not trouble to preserve them.

(2) Gould's Wattled Bat.

CHALINOLOBUS GOULDI (Gray, 1841).

This pretty little bat is readily recognised by the presence of a small skin tag, continuous with the outer margin of the ear, which projects as a little flap just behind the angle of the mouth.

The face is short and flat; the muzzle is broad, the animal having a face somewhat like that of a pug-dog. The ears are rather small and in general outline they are rounded. The inner margin is strongly convex above its origin, but subsequently becomes almost straight before curving to the tip. The outer margin sweeps round towards the angle of the mouth as a prominent fold, and, just behind the angle, terminates as the prominent flap, which passes downwards towards the throat. This flap faces directly forwards and projects as a little lappet with a rounded lower margin. (*See* Figure 283.) The tragus is large and is broadened at its upper extremity. The outer border is concave at its base and then proceeds with a bold convex curve towards the highest point. The inner border is slightly concave and runs unbroken to its point of attachment just anterior to the convex inner margin of the auricle. The nostrils are directed laterally. Their margins are well defined. The superior margin is inflected above in such a manner that the nostril is partly subdivided into anterior and posterior openings separated by a partial septum arising from the upper

margin. The skin of the face is dusky and freely beset with hairs in the greater part of its area. The muzzle itself is glandular and swollen, a prominent pad being situated upon either side of the rhinarium. The eyes are small. A small but well-defined pad is present just above and in front of the eye. The lower lip is naked for a small area in the middle line; a glandular elevation is present on either side of the middle line beneath the chin. From the naked central portion of the lower lip, towards the angle of the mouth, the lip margin is crenated and prominent. On the under surface of the jaw between the two prominent posterior extremities of the lips is a median glandular swelling which gives origin to a few vibrissae.

FIGURE 283.—*Chalinolobus gouldi*. Full face view of the head of an adult male. Three times natural size.

The patagium arises from the base of the first digit, the uropatagium taking origin from the ankle. The tail contains seven free vertebra, the tip of the terminal one just protruding from the uropatagium. The pes is small; the second, third, fourth, and fifth digits of almost equal length, the first being shorter. The fur is remarkably fine and velvety and the general colouration is characteristic, being practically black over the head and shoulders and rusty over the lower portion of the back and base of the tail. The hairs of the mid-dorsal region average 7 mm. in length. The hairs of the dorsal surface of the head and shoulders are coloured black in the whole of their length, with the exception of a minute portion at the extreme tip, which is light, these light tips being so minute as to be unnoticeable by the naked eye. Over the mid-dorsal region the pale tips become longer and rather more rusty, and they give the black hairs somewhat the appearance of having been lightly singed at the tip. Over the lower part of the back the hairs are rust-coloured in the greater part of their length, and those at the base of the tail and on the dorsal surface of the uropatagium are brown throughout. In this way the dorsal colouration shades off from black to brown in a very gradual manner, the actual colour of the fur appearing to be somewhat variable, depending

on the angle from which it is viewed. On the ventral surface the gradation is from rich chocolate brown to grey instead of from black to brown. The hairs of the chin and throat are rich deep brown with minute pale tips; those on the pubis are grey in almost the whole of their length. The membranes are a fine dark, almost purplish, brown. This description of the colouration of a typical South Australian example has been written from a fresh specimen, for (like many other bats) the animal fades when preserved as a dried skin and bleaches when preserved in spirits. It would appear that Dobson's description, which has been copied into most works dealing with the Australian mammals, was written from a specimen which was somewhat faded; and Ogilby's description which asserts the wing membranes to be "pale yellowish white" makes matters worse.

DIMENSIONS.

	♂	♀
Head and body	70	68
Ear	12	12·5
Tragus	4	4
Humerus	19	21
Radius	43	44·5
Digit I.	5·5	6
Digit III.	38	40
	18	18·5
	15	15·5
	7	7·5
Digit IV.	36·5	37
	14	15
	11	11
Digit V.	35	36
	9	9
	6·5	7
Femur	13	15
Tibia	18	20
Pes	7·5	7·5
Tail	45	47

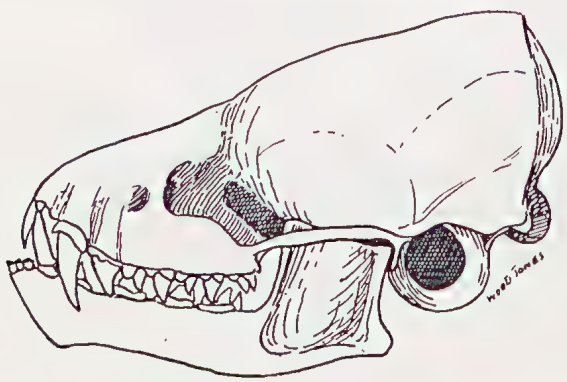

FIGURE 284.—*Chalinolobus gouldi*. Lateral view of skull of an adult male. Four times natural size.

The skull is remarkable in its general form and is distinguished by the relatively enormous size of the brain case. In consequence of the enlargement of the brain case, the whole skull assumes a wedge-shaped

outline, being high at the back and falling in a practically unbroken line to the muzzle region. (*See* Figure 284.) In the proportionate size of brain and body *Chalinolobus gouldi* must stand high, and in practically no other non-primate mammal does the proportion of cranial and facial elements in the skull become so conspicuously like that typical of the Primates. (For anterior teeth *see* Figure 285.)

DIMENSIONS OF SKULL.

	Adult ♂ from Ooldea.
Length	15
Breadth	11·5
Palate length	7
Interorbital constriction	5·3

This beautiful little bat is far more common in South Australia than is its smaller relative, *Ch. morio,* and, although in timbered districts it is a tree-haunting species, it is by no means confined to the more wooded southern portions of the State. Its range extends to the arid regions

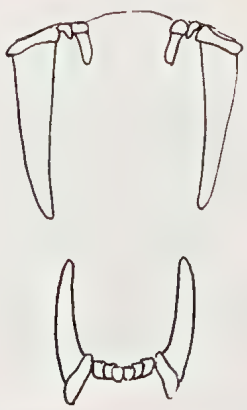

FIGURE 285.—Anterior teeth of *Chalinolobus gouldi.*

around Ooldea and eastward to Cooper's Creek. Specimens have been obtained from Melrose and from the Mount Lofty Ranges, and no conspicuous variation seems to be present in specimens from these varied localities. Its range extends to Tasmania.

GENUS 5.—EPTESICUS (Rafinesque, 1820).

The bats belonging to this genus are sturdily built and are distinguished by their flat, broad heads and obtuse muzzles. The face is made broader and flatter by the presence of glandular elevations on the sides of the muzzle. The ears are separated in the middle line of the crown of the head, and are short, broad, and obtusely pointed. The legs are short and strong, and the post calcaneal lobe is well developed. The feet are broad and short and the tail is less than the length of the head and body.

The dental formula is I. $\frac{2-2}{3-3}$. C. $\frac{1-1}{1-1}$. P.M. $\frac{1-1}{2-2}$. M. $\frac{3-3}{3-3}$.

The species of the genus are spread over both hemispheres and are extremely numerous. Only one representative occurs in Australia, and that one is included in the fauna of this State.

Little Bat.

EPTESICUS PUMILUS (Gray, 1841).

This, the smallest of all the Australian bats, is in general a dusky coloured, sturdily built little animal. The glandular elevations on the face are well developed and the muzzle is characteristically broad and flattened; it is depressed on its upper surface between the two glandular masses. (*See* Figure 286.) The nostrils are rather prominent; directed somewhat laterally, and crescentic in outline. Behind the muzzle, the crown of the head is flattened and depressed, but in the living animal this flattening is

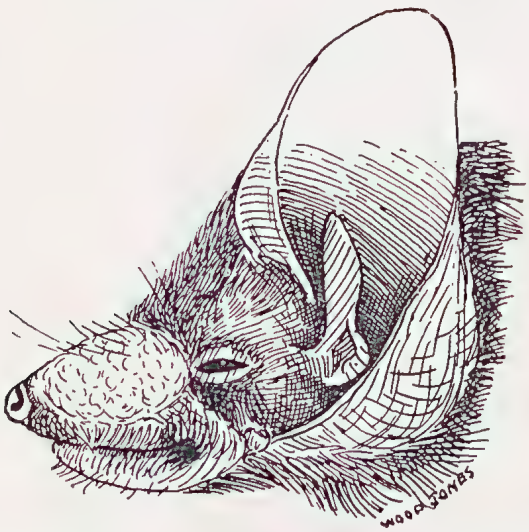

FIGURE 286.—*Eptesicus pumilus.* Characters of the head of an adult male. Four times natural size.

obscured by the upstanding velvety hairs of the head. The ears are markedly funnel-shaped; the outer margin being very ample in its lower portion. The upper portion of the outer margin is slightly concave above; below it ends at a small glandular tubercle just behind the angle of the mouth. The inner margin is strongly convex below. The tragus is long and rather broad; its inner margin is nearly straight, the outer margin having a convex lobe below. The eyes are small and are situated directly behind the glandular masses of the muzzle. The membranes are fixed to the bases of the toes; the calcaneum is long and well developed. The general colour of the dorsal surface is dusky brown, the hairs being black at their bases, and for about two-thirds of their length the tips are rusty brown. The hairs of the mid-dorsal region average 6 mm. in length. The ventral surface is a drab greyish, the hairs being black over the greater

part of their length, rust coloured at the tips below the throat, and grey at the tips over the abdomen. The membranes are black. The feet are small but sturdy; the first digit is the shortest and the remaining four are practically the same length. (*See* Figure 287.) The tail is short, the tip just extended from the uropatagium.

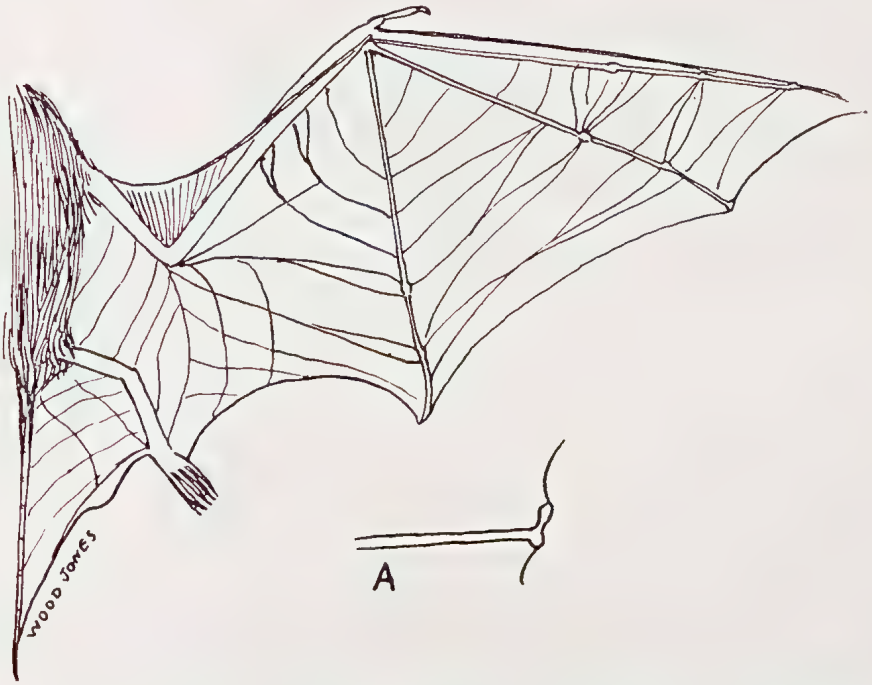

FIGURE 287.—*Eptesicus pumilus.* Outline of the membranes to show the main membrane markings. Natural size. A is an enlarged view of the termination of the fourth digit.

DIMENSIONS.

	♂	♀
Head and body	52	55
Ear	9	9·5
Tragus	5	5
Humerus	18·5	18·5
Radius	32	31
Digit I.	4	4
Digit III.	30	27
	12	11
	11	9
	7·5	6
Digit IV.	29	27
	10	9
	8	7
Digit V.	29	26
	9·5	8
	5·5	5
Femur	9	8
Tibia	13	12
Foot	5·5	5·5
Tail	32	28

The skull is somewhat flattened. The brain case is not nearly so well developed as in the Lobe-eared Bats. (*See* Figure 288.) The incisors of the lower jaw are minute. In the upper jaw the lateral incisor is an extremely ill-developed tooth, which leans against the outer side of its better developed, bilobed neighbour. (*See* Figure 289.)

FIGURE 288.—*Eptesicus pumilus*. Lateral aspect of the skull of an adult female. Four times natural size.

DIMENSIONS OF SKULL.

	Adult ♀.
Length	12
Breadth	8·5
Interorbital constriction	3·5
Palate length	6

The measurements given are those of typical specimens from the Adelaide district; but the species is subject to considerable variation in size.

A large series of specimens in the South Australian Museum may readily be divided into three groups.

Group i., with the radius 35-36 mm.

Group ii., with the radius 31-32 mm.

Group iii., with the radius 27-28 mm.

FIGURE 289.—Anterior teeth of *Eptesicus pumilus*,

Of these groups, No. ii. is by far the most numerous, and the specimens described above fall into it.

Of group i. there are six, and of group iii. three, specimens, whilst of group ii. there are no less than eighteen in my own collection or that of the

South Australian Museum. The basal lengths of the skulls of these three groups are as follows:—

Group i., condylo-basal length 14.

Group ii., condylo-basal length 12.

Group iii., condylo-basal length 11.

No other character, save mere size, distinguishes the members of these three groups, and since the geographical range of the groups and the nature of the seasons during which they grew to maturity are not known, the significance of these variations cannot be determined. It is, however, certain that the size is independent of sex, and the three groups appear to be discontinuous and not graded into each other by intermediate-sized specimens.

As with all the other Australian species, well-preserved specimens with proper *data* are very much needed in order that a proper study may be made of our native fauna.

This little bat occurs all over Australia and extends its range to Tasmania. Although widely distributed, it appears to be by no means common, and seems to have no special type of country as its elected habitat.

It occurs in the far North as well as in the Flinders Ranges and on the Adelaide Plains. It is nowhere abundant. It is said to produce two young at a birth, but nothing further appears to be known concerning its habits.

Genus 6.—SCOTEINUS (Dobson, 1878).

The bats of this genus are characterized by possessing short, broad, naked muzzles. There is so distinct a peculiarity in the flattened, broad anterior part of the face of these bats, that they may popularly be distinguished as Broad-nosed Bats.

The nostrils open rather close together; their openings are lunate and the inner margins are prominent. The ears are longer than broad and are notably thick in texture. The internal basal lobe is evenly convex and the outer margin of the auricle terminates behind the angle of the mouth in a distinct convex lobe. The tail is shorter than the head and body and the membranes are thick and leathery.

The dental distinction of the genus lies in the possession of only a single pair of upper incisors, placed close to the canines and separated from each other by a wide interval. The first lower premolar is a small tooth, placed almost transversely, and crowded into the interval between the canine and the second premolar. Dental formula:—I. $\frac{1-1}{3-3}$. C. $\frac{1}{1}\frac{1}{-1}$. P.M. $\frac{1-1}{2-2}$. M. $\frac{3-3}{3-3}$.

Three Australian species are included in the genus. The largest member, *S. rueppelli*, with a radius of 50 mm., does not occur in this State.

The intermediate member with a radius of 36 mm., which I take to be *S. balstoni,* is represented in the State Museum by a single specimen. The smallest, with a radius of 31-32 mm., known as *S. greyi,* is not a very rare bat in South Australia.

(1) Balston's Broad-nosed Bat.

SCOTEINUS BALSTONI (Thomas, 1906).

This bat may be recognised by its large flat muzzle, its warm brown colour, and its superiority in size over the other South Australian member of its genus.

The muzzle is extremely broad and almost flat above. (*See* Figure 290.) The glandular pads are well developed and nearly naked. The nostrils are rather wide apart; they are inflected from their upper margin and directed somewhat outwards. The gape of the mouth is rather a striking feature, the angle of the lips being behind the anterior angle of the eye.

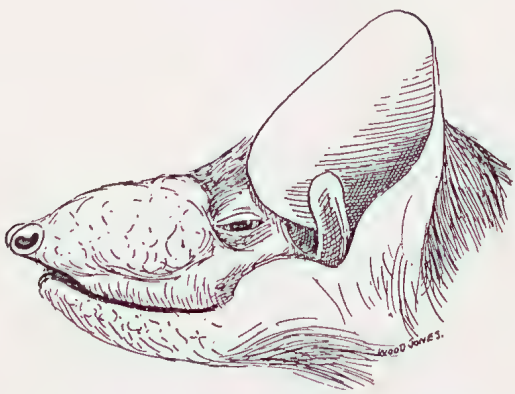

FIGURE 290.—*Scoteinus balstoni.* Characters of the head of an adult female. Three times natural size.

The lips are finely granular in texture and they give rise to a few, almost white, moustache hairs. The lower lip is naked and shining over a V-shaped interval in the middle line. A small tubercle giving rise to a little tuft of interramal vibrissae is present beneath the chin. The eyelids are swollen and glandular. The ears are rather more pointed than those of *S. greyi,* and in texture they are not quite so thick. The internal basal lobe is rounded. The upper portion of the inner margin of the auricle is practically straight. The outer margin is evenly rounded above, notched opposite the base of the tragus, and ends in a convex lobe just behind the angle of the mouth. The tragus is straight along its inner margin; the outer margin is convex below the tip, then indented, and convex again below. The body is sturdily built, the limbs stout, the membranes distinctly leathery in texture; these characters giving the bat a peculiarly robust appearance which it shares with *S. greyi.*

The patagium arises from the base of the first digit. The calcaneum is well developed, a post calcaneal lobe being present about 5 mm. from the ankle. The tip of the tail is just free of the uropatagium.

The fur of the dorsal surface is a rather bright brown, the hair is longer than in *S. greyi*. The individual hairs of the dorsal surface are dark brown at the roots and paler at the tips. The ventral surface is lighter, the hairs becoming ashy grey at the tips.

DIMENSIONS.

	♀ Riverton.	♀ Type, Thomas.
Head and body	56	55
Ear	14	15
Tragus	5·5	—
Humerus	18	—
Radius	36	36
Digit I.	4·5	—
Digit III.	35	—
	14	—
	11	—
	9	—
Digit IV.	32	—
	13·5	—
	10	—
Digit V.	34	—
	8·5	—
	5	—
Femur	14	—
Tibia	16	—
Pes	7·5	7
Tail	35	40

The skull is flattened, strongly built and ridged. The cranial and facial portions practically in a straight line. (*See* Figure 291.) The upper incisors large, near to the canines at their bases, but inclining inwards at

FIGURE 291.—*Scoteinus balstoni*. Lateral view of the skull of an adult female. Four times natural size.

their tips. The last molar considerably less than half the size of the tooth immediately in front of it. First lower premolar minute. Second premolar higher than the molars. Incisors crowded and placed in antero-posterior series. (*See* Figure 292.)

DIMENSIONS OF SKULL.

	♀	♀ Type. Thomas.
Length	15	15
Breadth	11	10·1
Interorbital constriction	4	—
Palate	7·5	—

The specimen of which the foregoing is a description was captured at Riverton, and is in the South Australian Museum.

I have identified this specimen as *S. balstoni* (Thomas, 1906), since its measurements agree so nearly with those of the type specimen and are so considerably larger than those of any specimens of *S. greyi* in the collections preserved in South Australia.

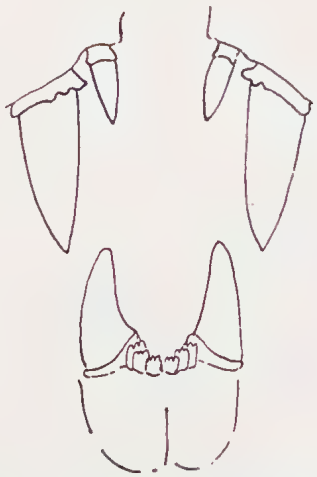

FIGURE 292.—*Scoteinus balstoni*. Anterior teeth of an adult female.

In describing this species Thomas does not comment on the difference in size between this animal and *S. greyi* as a point of distinction; but he dwells especially on the fact that the hairs are bicoloured in *S. balstoni*. All the specimens of *S. greyi* which I have examined also have bicoloured hair, and this point cannot therefore be accepted as a specific distinction. The size and the characters of the skull readily serve to distinguish the two species.

(2) Grey's Broad-nosed Bat.

SCOTEINUS GREYI (Gray, 1844).

This little bat is easily recognised by its broad nose, its rather thick erect ears, its sturdy build, its dull buff colour, and its leathery dull brown uropatagium.

The crown of the head is only slightly elevated above the face. The broad, flat muzzle is padded on either side by well marked naked glandular elevations. (*See* Figure 293.) The surface of these muzzle pads is very

distinctly glandular in texture. The ears are short, erect, and thick. The internal basal lobe is prominent and rounded; above the basal lobe, the inner margin is somewhat flattened, the tip of the ear being evenly rounded. The posterior margin evenly convex to beneath the tragus, where it is

FIGURE 293.—*Scoteinus greyi.* Characters of the head of an adult female. Four times natural size.

notched, and then, dilating into a distinct convex lobule, terminates behind the angle of the mouth. The tragus is rather broad, its inner margin straight, its outer margin convex above and straight below. The eyes are small, the skin surrounding them naked and granular. The whole of the

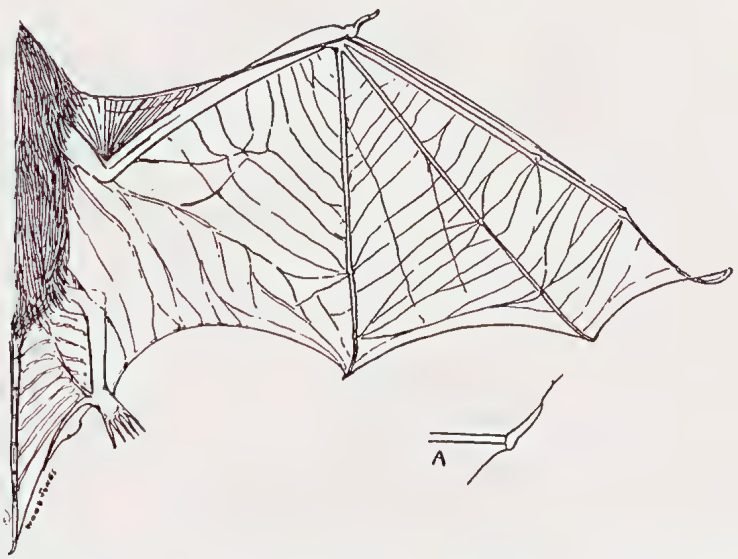

FIGURE 294.—*Scoteinus greyi.* Wing membrane showing main membrane markings. Natural size. A is an enlarged view of the termination of the fourth digit.

face in front of the eyes is practically devoid of hair, only a few short vibrissae taking origin from the glandular pads. The lower lip is naked and shining over a Y-shaped area in the middle line. A well-marked tubercle is present on each side behind the angle of the mouth and a single

one in the middle line beneath the chin. The patagium arises from the base of the first pedal digit. (*See* Figure 294.) A small but prominent post calcaneal lobe is present, separated by an interval of 3 mm. from the ankle. The tip of the tail, comprising practically the whole of the last joint, is free of the membranes. The limbs are fairly stout, the feet rather large, the third digit being the longest. The fur is short, averaging only some 4 mm. in the mid-dorsal region. The general colour of the dorsal surface is a rather dull buff brown, the hairs being somewhat lighter at the bases than at the tips. The ventral surface is pale greyish brown, the hairs being slightly darker at their bases than at their tips. The membranes are brown, the patagium itself being considerably darker than the uropatagium, which is about the same colour as the dorsal fur.

DIMENSIONS.

	♂	♀
Head and body	44	48
Ear	10	11
Tragus	4	4
Humerus	15	15·5
Radius	31	32
Digit I.	4	4
Digit III.	28	29
	11·5	12
	9	9
	6	6
Digit IV.	26	27
	11	11
	9·5	9·5
Digit V.	26	27
	7	7
	5	5
Femur	8	8
Tibia	11·5	12
Pes	6	6
Tail	27·5	27

FIGURE 295.—*Scotoinus greyi*. Lateral view of the skull of an adult female. Four times natural size.

The skull is flattened and robustly built; the brain case is but little larger than the facial portion of the skull, and it rises only slightly above the level of the muzzle. (*See* Figure 295.) The upper incisors arise close to the canines and their tips are inclined towards the middle line. Last

upper molar less than half the size of the tooth immediately in front of it. First lower premolar minute.

DIMENSIONS OF SKULL.

	♂	♀
Length	12·5	13
Breadth	8·5	9
Interorbital constriction	4	4
Palate	5	5·5

This little bat has a wide range in Australia. Recorded in the British Museum Catalogue only from Port Essington and the Liverpood ranges, it appears to have been assumed to be a Northern form. It has, however, been obtained from several localities in South Australia, among them being Stuart's Creek, Paralana Ranges, and the Murray districts. So far as I can ascertain, nothing has been recorded of its habits save that in the Centre it lives in hollow trees.

Sub-family II.—**MINIOPTERINAE.**

The Sub-family is founded on the peculiar enlargement of the anterior part of the sternum, and the straight form of the coracoid bone. Only one genus is contained in the Sub-family.

Genus MINIOPTERUS (Bonaparte, 1837).

The little bats belonging to this genus are easily distinguished on account of the great length of the tail and the extent of the uropatagium within which it is wholly contained. The crown of the head is well elevated above the level of the face. The ears are separated, their outer margins arising from the angle of the mouth; the tragus is short, its inner margin straight, its outer margin convex. The muzzle is broadened and marked by glandular elevations. The nostrils are simple and crescentic; the rhinarium separated from the upper lip by a groove. The first phalanx of the third digit of the manus is very short, being less than one-third the length of the terminal phalanx, which is flexed forwards on to the ventral surface of the metacarpal when the patagium is not spread for flight. Patagium attached to the tibia or ankle. The feet are long and slender, the toes nearly equal in length. The tail is as long as the head and body, and is wholly contained within the greatly elongated uropatagium.

Dentition:—I. $\frac{2-2}{3-3}$. C. $\frac{1-1}{1-1}$. P.M. $\frac{2-2}{3-3}$. M. $\frac{3-3}{3-3}$.

The skull is distinguished by a steeply vaulted brain case; the palate extends backwards very slightly behind the anterior root of the zygoma. The genus ranges on both sides of the Equator in the Eastern Hemisphere from Africa and South-West Europe to Australia.

Only one species has been recorded in South Australia; the second Australian species, *M. australis* (Tomes, 1858), distinguished by its smaller size and hair-covered membranes, being apparently confined to the northern portion of the Continent.

Schreiber's Long-tailed Bat.

MINIOPTERUS SCHREIBERSI (Natterer, 1819).

This very variably coloured bat is easily recognised by its size, its long tail, its bent-up joint of the longest finger, and the shortness of the joint immediately preceding the bent one.

The muzzle is short and rounded. The glandular prominences are well developed and sharply marked off from the naked rhinarium. (*See* Figure 296.) The nostrils face almost directly forwards. They are boldly crescentic in outline and their inner margins are well defined. The portion of the rhinarium entering into the formation of the upper lip is naked and granular; the remainder of the upper lip is clothed with a short moustache. The lower lip is simple. The eye is fairly large, the eyelids prominent,

FIGURE 296.—*Miniopterus schreibersi.* Characters of the head and face of a female. Four times natural size.

and the lower lid is separated from the glandular swelling of the upper jaw by a fairly deep groove. The ears are short, roughly triangular in form, and erect. The inner margin is strongly convex below, passing forwards on to the face as far as the anterior angle of the eye. From the bold convex lower curve the inner margin passes straight upwards and backwards to the tip. The outer margin is fairly straight above, convex below. Opposite the tragus it is notched and thence passes as a well-marked, squarish lobe, which terminates behind the angle of the mouth. The tragus is broader above than below; the inner margin is concave, the outer margin convex above; both margins are practically straight below. The greater part of the face is clothed with short erect hairs. The crown of the head rises sharply above the face.

The patagium arises from the lower end of the tibia just above the ankle. (*See* Figure 297.) The calcaneum is slender, there is no definite

post calcaneal lobe. The tail is as long as, or longer than, the head and body, and is wholly contained within the uropatagium. The third digit of the manus is in every way remarkable; the second joint is practically only one-quarter the length of the first joint, and the last joint is bent so that it lies along the underside of the first and second joints. The feet are well developed; the digital formula is $2 > 3 > 4 > 5 = 1$. The colour of the fur, naked skin, and membranes varies remarkably. Specimens from the more northern parts of this State are commonly rather bright red-brown, darker above than beneath. Examples from the caves in the South

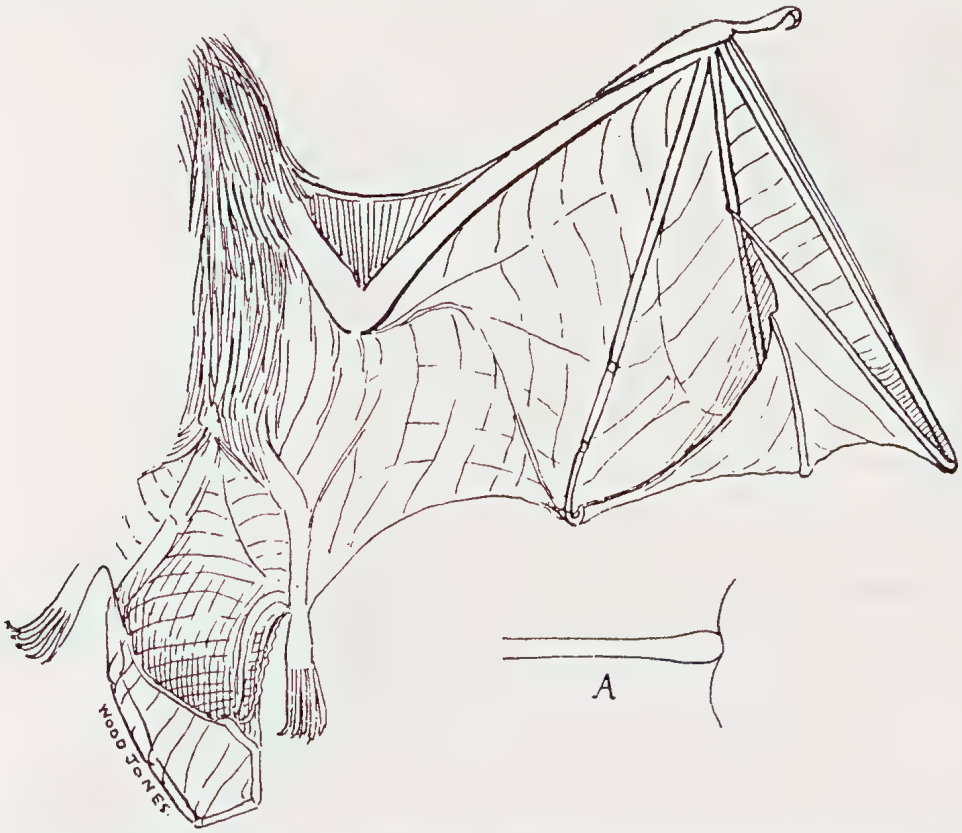

FIGURE 297.—*Miniopterus schreibersi.* Outline of wing membranes and main membrane markings of an adult female. Natural size. A is an enlarged view of the termination of the fourth digit.

are uniformly dark brown. In the typical bright red-brown form the fur is uniform in colour from root to tip on the dorsal surface and darker at the roots than at the tips on the ventral surface. The naked skin is yellowish and the membranes light brown, the uropatagium being palest. The dark form is almost chocolate coloured above, but the hairs of the ventral surface are reddish-grey at the tips. The naked skin and membranes of the dark form are dusky brown, the uropatagium being but little lighter than the rest of the membranes. There are no structural distinctions between the two common colour forms, and certain specimens from the far North are far paler than the normal red-brown specimens.

In these far northern examples it is not uncommon for the ears and the uropatagium to be nearly white and for the ventral fur to be pale buff. To such pale colour variations belongs the described form *Miniopterus schreibersi pallidus* (Thomas, 1914), and, probably, *Miniopterus orianae* (Thomas, 1922), from Port Darwin.

DIMENSIONS.

	Dark ♂ from Naracoorte, S.E.	Light ♀ from Melrose.
Head and body	59	52
Ear	12	11·5
Tragus	6·5	6·5
Humerus	23	20
Radius	48	46
Digit I.	5	4·5
Digit III.	42	40
	10·5	10
	40	37
Digit IV.	40	36·5
	9	9
	18	15·5
Digit V.	36	33
	10	10
	9	8·5
Femur	18·5	17
Tibia	19·5	18
Foot	11	9
Tail	61	53

The skull is of remarkable form and is readily distinguished from that of a member of any other genus. (*See* Figure 298.) The brain case is extremely large relatively to the muzzle region. The cranium rises sharply

FIGURE 298.—*Miniopterus schreibersi*. Lateral view of the skull of an adult female. Four times natural size.

from the facial portion of the skull, and forms a rounded swollen frontal boss; behind this enlarged frontal region the brain case is constricted for an interval and then dilates again at the hinder end. The two upper

incisors of each side slope inwards at their tips and are separated from the canines by a distinct interval. The central incisor is slightly larger than the lateral member. (*See* Figure 299.)

DIMENSIONS OF SKULL.

	Light-coloured ♀ from Mount Lofty.
Length	16
Breadth	10
Interorbital constriction	4·5
Palate	8·5

This very variably coloured bat is by no means uncommon in South Australia, and the examination of good series of specimens provides convincing evidence that though the colour of the fur, membranes, and naked skin varies widely, these colour variations are unassociated with any other alteration of character.

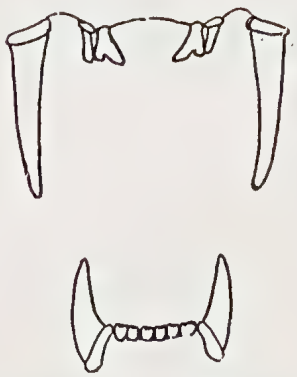

FIGURE 299.—Anterior teeth of *Miniopterus schreibersi*.

In many ways this bat is a most remarkable animal, for it ranges from Southern Europe, Asia, Africa, and Madagascar, through Japan and the Philippine Islands and the Malay Archipelago to Australia. Although over this wide area a more extended range of colour variation is seen than that which exists within the limits of Australia alone, the species remains constant in other and more important characters. It is a species which mostly lives in communities of some size and usually inhabits caves. In the South Australian Museum is a good series of the very dark form captured in the Naracoorte caves in the South-East.

SUB-FAMILY III.—KERIVOULINAE.

In general features the members of the Sub-family resemble the Vespertilioninae, but the sternum is very much shortened and only four or five ribs articulate with it. Two genera are contained within the Sub-family, and a representative of one genus extends its range into Australia.

Genus KERIVOULA (Gray, 1842).

The members of the genus are distinguished by the elevated crown of the head and the narrow elongated muzzle. The tail is as long as, or longer than, the head and body, and the ears are funnel-shaped and thin in texture. These bats are delicately formed and are forest-haunting animals.

Dental formula:—I. $\frac{2-2}{3\ 3}$. C. $\frac{1-1}{1\ 1}$. P.M. $\frac{3\ 3}{3-3}$. M. $\frac{3-3}{3\ 3}$.

Only one member of the genus, *Kerivoula papuensis* (Dobson, 1878), which was originally described from Port Moresby, New Guinea, has been recorded from North-eastern Australia.

It is not an inhabitant of South Australia.

Sub-family IV.—**NYCTOPHILINAE.**

The members of this Sub-family are distinguished from all other members of the family Vespertilionidae by the curiously truncated muzzle. The exact relationships of the Sub-family are by no means easy to determine, the position being made more complex by reason of the fact that these bats possess a very evident nose-leaf. Two genera, the one American and the other Australian, are contained in the Sub-family. The actual relation of these, geographically, widely separated genera to each other is by no means clear. Even when we have to limit ourselves to the single Australian genus, considerable difficulty is encountered; for although much work has been done in the way of describing minute specific differences, we are far from having any real understanding of the relationships, the real specific distinctions, or the geographical distribution of the Australian species.

Genus NYCTOPHILUS (Leach, 1822).

The members of this genus possess a small nose-leaf and large ears, which are joined together over a wide interval across the forehead. (*See* Figure 300.) The face is slightly hairy. The nostrils open at the extremity of the muzzle and they are surmounted by a small nose-leaf. Above and behind the nose-leaf is a second rounded and fleshy elevation. The ears are large, oval in outline, and joined together by a band uniting their inner margins across the forehead. The tragus is short and somewhat triangular in outline. The patagium springs from the base of the first pedal digit. The extreme tip of the tail alone is free from the uropatagium.

Dentition:—I. $\frac{1\ 1}{3\ 3}$ or I. $\frac{1-1}{2\ 2}$. C. $\frac{1-1}{1\ 1}$. P.M. $\frac{1-1}{2-2}$. M. $\frac{3\ 3}{3-3}$.

The genus is confined to the Australasian region and does not appear to be represented in New Zealand.

The Australian Long-eared Bats constitute an extremely complex little group, which only a few years ago passed, and in some Australian works on Zoology still pass, in apparent simplicity under the single title of *Nyctophilus timoriensis* (Geoffroy, 1806).

The actual bat to which this name was given cannot now be determined, and the name has, therefore, been superseded.

Instead of there being but a single member of this peculiarly Australasian genus, there is an assemblage of species and sub-species, the differential points of which are at times extremely difficult to determine. In order to assist the student, the species and sub-species so far described are tabulated with their distinguishing characters.

(1) Nyctophilus major (Peters, 1860).

Size largest of the genus. Skull measures 19·8 mm. in its maximum length. Upper tooth row 7·3 mm. Bullae 4·3 mm. Leaf-nose but little developed.

Western Australia.

(2) Nyctophilus geoffroyi (Leach, 1822).

Size small; ears large. Nose-leaf very highly developed. Bullae large.

(a) *N. geoffroyi geoffroyi* (Thomas, 1915).

Skull 14 mm. in condylo-basal length, upper tooth row 5·5 mm. Bullae 4 mm.

Colour rather dark.

Western Australia.

(b) *N. geoffroyi pallescens* (Thomas, 1913).

Skull with greatest length 15·3 mm., upper tooth row 5·7 mm. Bullae, 3·8 mm.

Somewhat paler coloured.

Northern South Australia.

(c) *N. geoffroyi pacificus* (Thomas, 1915).

Skull with greatest length 15·8 mm. Upper tooth row 5·5 mm. Bullae 3·8 mm.

Dark coloured.

Tasmania and South-Eastern Australia.

(3) Nyctophilus sherrini (Thomas, 1915).

Large in size, but slightly less than *N. major*. Ears medium. Nose-leaf only little developed. Skull with greatest length 18·5 mm. Upper tooth row 6·9 mm. Bullae 4·2 mm.

Tasmania.

(4) Nyctophilus gouldi (Tomes, 1858).

Size rather large; ears large. Nose-leaf medium in development. Skull with greatest length 17·7 mm. Upper tooth row 6·4 mm. Bullae 4·2 mm.

New South Wales and South Queensland.

(5) Nyctophilus bifax (Thomas, 1915).

Fairly large. Ears small. Colour medium. Nose-leaf very undeveloped. Skull with greatest length 17·7mm. Upper tooth row 6·5 mm. Bullae 3·5 mm.

North Queensland.

(6) Nyctophilus microtis (Thomas, 1888).

Like *N. bifax* but smaller. Upper tooth row 5·6 mm.

(a) *N. microtis microtis* (Thomas, 1915).

Brown both above and below.
Owen Stanley Range, New Guinea.

(b) *N. microtis bicolor* (Thomas, 1915).

Greyish brown above, greyish white below.
Lowlands, British New Guinea.

(7) Nyctophilus daedalus (Thomas, 1915).

Fairly large, ears rather small, nose-leaf little developed. Brown in colour. Bullae, 3·6 mm.

Northern Territory.

(8) Nyctophilus walkeri (Thomas, 1892).

Smaller and with shorter ears than any of the other species. Nose-leaf medium. Skull with greatest length 13 mm. Upper tooth row 4·7 mm. Bullae 2·8 mm.

Northern Territory.

The following description applies to the form which occurs round Adelaide.

Geoffroy's Long-eared Bat.

Nyctophilus geoffroyi (Leach, 1822).

The ears are large, oval in outline, and when pulled forward reach far in advance of the muzzle. (*See* Figure 301.) In texture they are thin and membranous, and are marked by a series of transverse lines which run at intervals of about a millimetre across the length of the auricle. The inner margin sweeps upwards and towards the middle line of the head with a bold curve, and at the point of its maximum convexity, which is near the mid-point of its length, it is joined to its fellow of the opposite side by a deep membranous band, which joins the forehead on a level with the anterior margin of the eye. The tip of the ear is rounded. The upper portion of the outer margin is almost straight; the lower portion boldly

convex, sweeping round to join the side of the head just behind the angle of the mouth. (*See* Figures 300 and 301.) The tragus is rather short and in general form is roughly triangular with the angles rounded; its anterior margin is markedly convex; the posterior margin with a slightly thickened and folded lobe about the middle of its length.

The small nose-leaf above the nostrils about as high as the distance between the two nostrils. (*See* Figure 300.) The upper, free, and longest

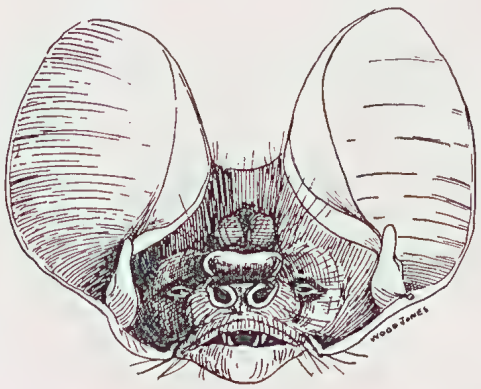

FIGURE 300.—*Nyctophilus geoffroyi*. Full face view of the head of an adult male. Twice natural size.

edge curved slightly downwards in the middle line. The leaf itself is depressed immediately above the upper margin of the nostrils. The glandular elevation above and behind the nose-leaf consists of two bilateral masses connected by a membrane, but separated to a varying extent at the

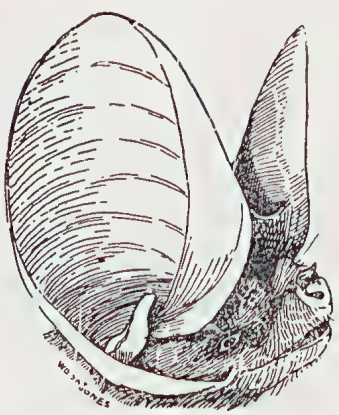

FIGURE 301.—*Nyctophilus geoffroyi*. Side face view of the head of an adult male. Twice natural size.

middle line. The posterior surface of these elevations is almost in approximation with the anterior surface of the bar connecting the two ears.

The nostrils are simple, crescentic in outline, and incomplete at their upper and outer margin.

The face is hairy, the eye surrounded by well-marked, dark hairs. Facial vibrissae fairly well developed. The general colouration of the body hair varies considerably, but the dorsal is always darker than the ventral surface. The fur is fine and soft, dark at the roots, paler at the tips. Individual hairs of the mid-dorsal region 8 or 9 mm. in length. The dorsal surface varies from dark brown to pale grey, many specimens having a distinct olive grey tint. The ventral surface from pale brown to grey or almost white. Membranes as a rule dark, but in some specimens of a warm umber brown. Propatagium with a maximum depth of 8·9 mm. Free edge of patagium between digits 3 and 4 measures in three specimens 15, 21, and 18 mm.; free edge between digits 4 and 5 measures 36, 42, and 41 mm. in the same specimens respectively. Terminal phalanx of fourth digit ending as a small, bifid, expansion of which the preaxial limb is about twice the length of the postaxial. Patagium attached to base of first pedal

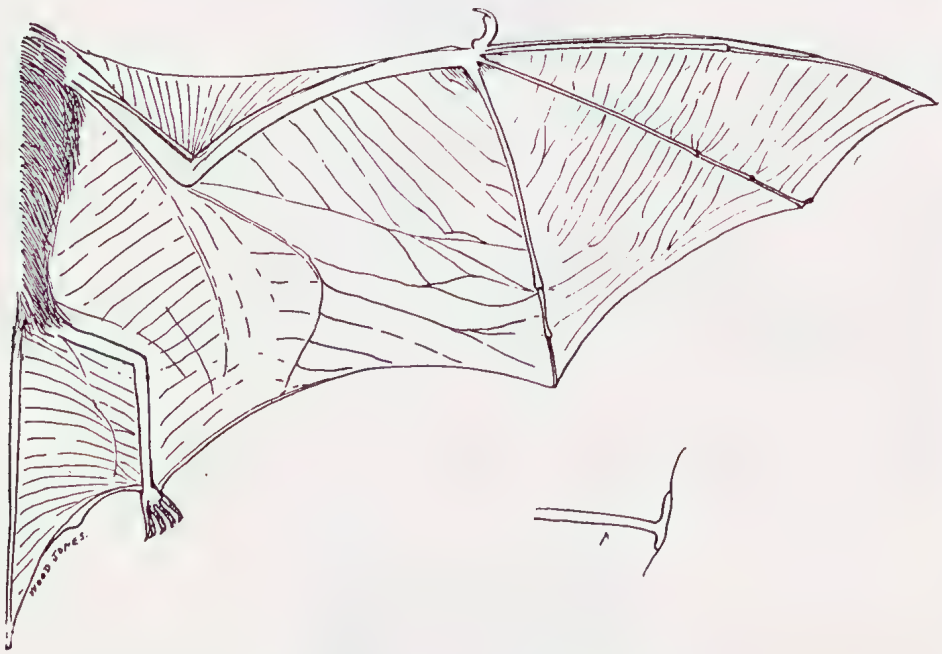

FIGURE 302.—*Nyctophilus geoffroyi*. Wing membrane showing main membrane markings. Natural size. A is an enlarged view of the termination of the fourth digit.

digit. Calcaneum three-quarters the length of the tibia, with a small post calcaneal lobe near its mid point. Tip of the tail free of the uropatagium. Details of membrane markings as in Figure 302.

The skull with short, expanded, and concave nasal region, rounded brain case, and large bullae. The palate extends backwards behind the mid-point of the zygoma.

Dentition as in Figures 303 and 304.

The minute tricuspid lower incisors extremely crowded, and in some examples the development of one pair is suppressed. Eight vertebrae are included in the tail.

DIMENSIONS.

	♂	♀
Head and body	44	46
Ear	23	24
Tragus	7	8
Humerus	18	19
Radius	38	39
Digit I.	5	6
Digit III.	32	37
	12	16
	12	14
	6	6
Digit IV.	31	36
	10	13
	10	12
Digit V.	32	36
	9	11
	8	9
Femur	13	16
Tibia	17	21
Foot	6	6
Tail	42	43

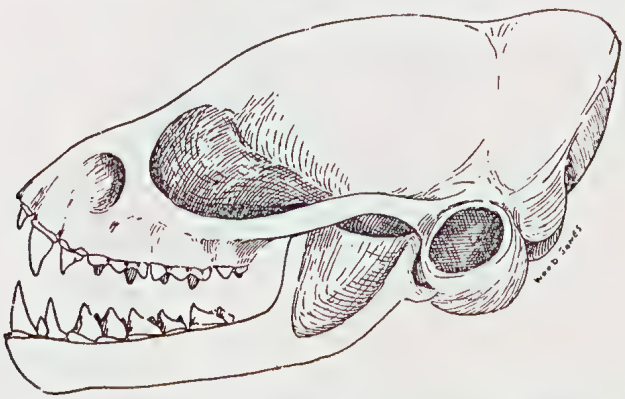

FIGURE 303.—*Nyctophilus geoffroyi*. Lateral view of the skull of an adult male. Five times natural size.

DIMENSIONS OF SKULL.

	♂	♀
Length	14	14·5
Breadth	9	9
Constriction	3	3
Palate	8	8

The little Long-eared Bat under some of its many sub-specific forms appears to be the commonest and most widely distributed species met with in Australia.

In South Australia it appears to be universally distributed, and it lives in the timbered districts of the coast, the scrub and mallee country, and in

the arid interior. It is abundant in Kangaroo Island. It usually makes its home in any small chink in a dead branch of a tree, or beneath a loosened slab of bark. In the centre it almost invariably selects a dead and hollow mulga. Although at times it congregates in large colonies, as a rule only

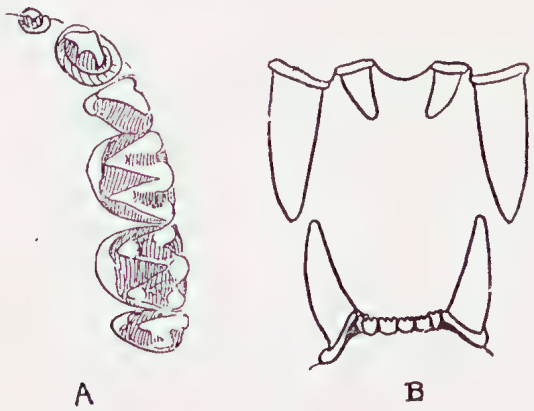

FIGURE 304.—*Nyctophilus geoffroyi*. Dentition. A the upper tooth row of the left side. B the front teeth of both jaws.

one or two individuals are found inhabiting a single hollow branch. It flies early in the evening and appears to be on the wing all the year round.

The Sub-species *N. geoffroyi pallescens* is the dominant form in the northern part of the State, and has been obtained from Ooldea, Melrose, Mount Eba, Miller's Creek, and McDouall's Peak.

FAMILY IV.—MEGADERMIDAE.

The members of this family are in every way remarkable bats. They are characterised by the possession of long, erect, nose-leaves; large ears with bifid tragi, and a tail so short as to be unrecognisable externally.

The second digit has one phalanx, the third two. The fibula is present but in a rather undeveloped form. The incisor teeth are absent in the upper jaw. Only one genus—in some ways the most remarkable of the five contained in the family—inhabits Australia.

GENUS MACRODERMA (Miller, 1906).

This genus is confined to Australia and contains only one species. The genus is distinguished from others contained in the Family by the fact that it possesses only one upper premolar tooth and that its molar teeth represent the extreme phase of molar development characteristic of the family.

The dental formula is:—I. $\frac{0\ 0}{2-2}$. C. $\frac{1\ 1}{1-1}$. P.M. $\frac{1-1}{2\ 2}$. M. $\frac{3-3}{3\ 3}$.

Of this peculiar genus there is only one species.

Great Carnivorous Bat.

MACRODERMA GIGAS (Dobson, 1880).

Apart from its large size and grotesque aspect, the most noteworthy character of this remarkable species is its bleached appearance, due to its almost white membranes and its pure white hair on the ventral surface.

The muzzle is elongated and simple; the lower jaw is projecting and prominent, so that the face, although fairly long, has a bull-dog-like expression. The ears are extremely large, thin, and leaf-like, and stand erect above the head. They are united in the middle line over half the extent of their inner margins, so that the conjoined inner edge of the two ears stands straight above the face as a septum. (*See* Figure 305.)

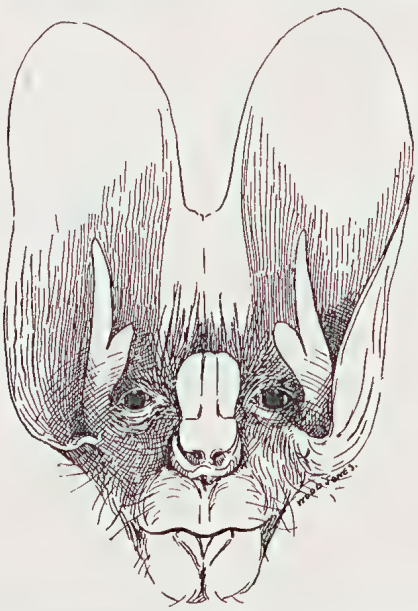

FIGURE 305.—*Macroderma gigas*. Full face view of an adult female. Natural size.

The tips of the ears are rounded off and oval; the outer margins are simple and are connected with the face some distance behind the angle of the mouth. The tragus is of very remarkable form, being bifurcated above into a posterior thin, erect, portion and an anterior, shorter, widened process. The eye is fairly large. The nose-leaf is elongated from above downwards, and consists of an erect, oval leaf, the upper portion of which consists of a thin, flat plate with a raised median thickening. This median elevation, which marks the mid-line of the upper leaf-like portion, expands below and forms a secondary shield between the nostrils. The extremity of the second digit of the manus extends beyond the middle of the first phalanx of the third digit. The membranes arise from the outer side of the foot. The calcaneum is well developed. There is no post calcaneal lobe. The tail, as an external organ, is altogether absent, but the uropatagium is well developed. The pes is large and strong, all the digits being of practically the same length. The claws are strong and curved.

The ears, nose-leaf, and membranes are almost white. The hair of the dorsal surface is white with pale greyish-brown tips. The head and the whole of the ventral surface is pure white. Fine hairs are carried on to the membranes along the line of the second digit.

DIMENSIONS.

	♂ type Dobson.	♀ Waite.	♂ "Mummied" Cave Specimen.
Head and body	135	110	140
Ear	56	47	51
Tragus	25·5	22	25
Joined margin of ears above head	—	—	26
Nose leaf	16	15	17 x 11
Humerus	—	—	44
Radius	117	103·5	105
Digit I.	21	19·5	13
Digit II.	84·5	80·5	80
	16	17	18
Digit III.	69	68	68
	47	44	47
	92	80	82
Digit IV.	79	78	76
	25·5	24·5	28
	38·5	33	37
Digit V.	84·5	82	81
	32	33	34
	28·5	23·5	25
Femur	—	—	34
Tibia	44	45	46
Calcaneum	28·5	28	28
Pes	28·5	23·5	23

FIGURE 306.—*Macroderma gigas*. Lateral view of the skull of a male. One and a half times natural size.

The skull is stoutly built and strongly crested. (*See* Figure 306.) The post-orbital processes are present, and Dobson's observation that they are not perforated by a foramen does not hold good in the specimens in my possession. The interorbital constriction is extremely well marked. The frontal portion of the skull is concave. The long upper canine teeth have

two secondary cusps springing from the cingulum. Upper incisors absent. Lower incisors minute. (*See* Figure 307.)

DIMENSIONS OF SKULL.

	♂
Length	36·5
Breadth	25
Interorbital constriction	4
Palate	14

The original specimen, which was described by Dobson in 1880, came from Mount Margaret, Wilson's River, Queensland, and is preserved in the Göttingen Museum. The bat was secured again in 1890 by Inspector Besley at Alice Springs, and in October of that year the late Mr. A. Zietz, in ignorance of Dobson's work, announced it as a new species, and an addition to the Australian fauna, but he neither named nor described the two specimens that were sent to him. In 1894 the Horn Expedition obtained a single specimen from a cave amongst the McDonnell Ranges

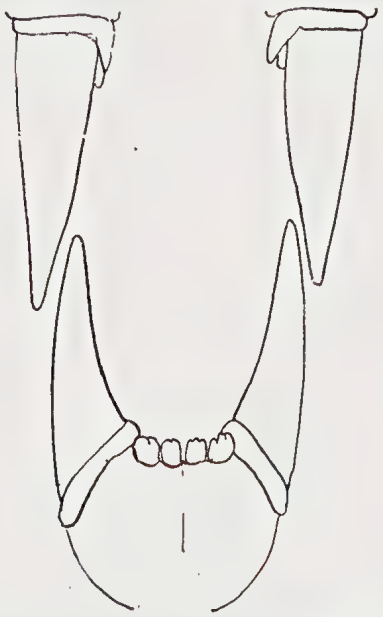

FIGURE 307.—*Macroderma gigas.* Anterior teeth of an adult male.

near Alice Springs. In this cave it had formerly been numerous, but, owing to the partial filling in of the cave, the bats had disappeared with the exception of a solitary individual. After the expedition returned two more specimens were obtained from Mr. F. J. Gillen.

In 1900 Waite reported another specimen from Pilbarra, Western Australia. It is, therefore, obvious that the animal is distributed across the breadth of the Continent in the more tropical North. The remarkable fact, however, is that at one time it was a common cave species over a very wide area in South Australia. In the Buckalowie and Arkoona

Caves in the Carrieton district I found the remains of this bat in large quantities, and from many caves in the Flinders Ranges its remains have been reported, in many cases in the form of almost perfect mummies. By the kindness of Dr. A. M. Morgan I have received a perfect mummy from the Wooltana Caves, and this specimen is in so good a state of preservation that the hair and all the dermal appendages are perfect.

In these caves, *Macroderma gigas* appears to have lived for long ages, for the accumulations of guano, which have been exploited commercially, were apparently due to the long occupation by these large bats. During their tenancy they shared the caves with the extinct *Thylacoleo* and *Thylacinus,* whose remains are found in the guano deposits; but even in the Carrieton Caves they long outlived these extinct creatures, for their remains are also found among the most recent deposits, and their perfectly preserved, but fragile, bodies tell of their comparatively recent occupation. *Macroderma gigas* would seem to be an important link in the story of the passing of an archaic fauna from a progressively dessicating interior of the Continent. It lingered on for some time after the heyday of the archaic specialised marsupials was passed. It lingered on until the changed conditions of the increasingly desert environment made the obtaining of sufficient food impossible even for a powerful and volant animal. This bat, in works dealing with Australian zoology, is usually known as the Great Blood-sucking Bat. But it is no blood-sucker in the sense in which this term is applied to the true vampires. I have examined the intestinal contents of cave mummies and it consists entirely of masses of the hairs of small insectivorous bats. There is no doubt that *Macroderma gigas* is a carnivorous form which preys on other bats, it is a bat-eating bat, and the remains of small insectivorous bats are present in the caves which it inhabited. It would seem that the changed condition of our northern areas had led in the first place to a diminution in the insect life, and so to a decrease in the number of insectivorous bats on which *Macroderma* could prey. For the philosopher, or for the politician, who regards the north of this State as a paradise likely to continue improving, there is this to remember, that within comparatively recent times the increasing dessication has driven *Macroderma gigas* from Carrieton to Alice Springs—and beyond. It would be a difficult matter to find a place in South Australia to-day where conditions were so luxuriant that sufficient insectivorous bats could be congregated in order to sustain a cave-full of *Macroderma.*

Family V.—RHINOLOPHIDAE.

The members of this, the typical family of Leaf-nosed Bats, possess large ears without a tragus, in addition to well-developed and conspicuous nose ornaments. Coupled with these features is the normal nature of the pes, in which all the digits possess three phalanges with the exception of the first, which has two. Only one genus is contained in the family.

Genus RHINOLOPHUS (Lacépède, 1799).

Over a hundred species are included in the genus. The dental formula is:—I. $\frac{1-1}{2\ 2}$. C. $\frac{1-1}{1\ 1}$. P.M. $\frac{2-2}{3\ 3}$. M. $\frac{3\ 3}{3-3}$.

The first upper premolar and the second lower premolar are minute, functionless, and usually crowded out of the tooth row. The outer margin of the ear is developed into a well-marked anti-tragus.

Of the great number of species of *Rhinolophus,* only one—*R. megaphyllus* (Gray, 1834) is Australian, and it is apparently confined to Northern New South Wales and Queensland.

Family VI.—HIPPOSIDERIDAE.

This family of Leaf-nosed Bats is at once distinguished by the fact that all the digits of the pes are of practically the same length and only possess two phalanges apiece. Coupled with this peculiarity are certain specializations of the limb girdles, and a tendency for the lumbar region of the spine to become fused into a solid rod by the obliteration of the joints. With the exception of these specializations, the members of this family resemble the *Rhinolophidae.*

Seven genera are included in the family, and of these one has Australian representatives and a second is confined to Australia.

The two Australian genera are easily distinguished as follows:—

(A.) The nasal horse-shoe without a horizontal crest between and above the nostrils. The posterior part of the zygoma unexpanded.

Genus 1. *Hipposideros.*

(A^1.) The nasal horse-shoe with a horizontal crest between and above the nostrils. The posterior part of the zygoma expanded into a wide plate.

Genus 2. *Rhinonycteris.*

Genus 1.—HIPPOSIDEROS (Gray, 1831).

This large genus of Horse-shoe Bats contains about forty species, which range from Morocco to the Philippine Islands, New Ireland, and Australia. Two species have been recorded from the Australian Continent. Of these, *Hipposideros cervinus* (Gould, 1853) was originally taken on Albany Island, Cape York, and it ranges to Aru and New Guinea. The second species, *H. bicolor* (Temminck, 1835), is also recorded from Aru and Albany Island. Neither form has been captured in this State.

Genus 2.—RHINONYCTERIS (Gray, 1847).

This peculiarly Australian genus of the Leaf-nosed Bats is distinguished by the following characters. The nose-leaf is complicated, and consists of a horse-shoe-shaped lower portion surmounted by a complex, crown-like,

narial process. The ears are separate, and lack a tragus. The outer margin of the auricle arises just behind and slightly below the eye. The eyes are small; the face is hairy; the crown of the head rises above the face. The patagium arises well above the ankle. The terminal phalanx of the fourth digit is bifid and bar-like at its extremity. The hind limbs are extremely long and slender. The tail is short and only its extreme tip is free of the uropatagium. The skull is of peculiar and characteristic form. (*See* Figure 310.) The dentition is also peculiar in that the upper canine tooth has a large secondary cusp.

Dentition:—I. $\frac{1}{2}\frac{1}{2}$. C. $\frac{1}{1}\frac{1}{1}$. P.M. $\frac{2-2}{2\ 2}$. M. $\frac{3\ 3}{3-3}$.

The genus is confined to Australia, and only one member has so far been discovered.

Golden Horse-shoe Bat.

RHINONYCTERIS AURANTIA (Gray, 1845).

Size small, general colour golden, membranes pale; nose-leaf well developed and complicated.

The crown of the head is well raised above the face, the face itself being almost entirely occupied by the nose-leaf. The ears are short; laid forward they cover the eye; they are sharply pointed at the tip. The inner margin of the auricle sweeps forward with a fairly uniform convexity

FIGURE 308.—*Rhinonycteris aurantia.* Full face view of the head of an adult female. Three times natural size.

to the tip; the outer margin starts straight, or slightly concave, from the tip and then sweeps round, boldly convex, joining the side of the head behind and slightly below the eye. The inner margins are widely separated by the crown of the head. The nose-leaf is large and complex; it consists of two parts, a lower part which forms a horse-shoe ring below the nostrils and an upper part which surmounts the nostrils. The lower part consists of two bilateral leaves, notched in the middle line below,

and there joined by a projecting shelf, which springs from the interspace between the nostrils. From the inner margin of each of the leaves a small curved projection passes along the outer margin of each nostril. The complex upper portion of the nose-leaf surmounts the nostrils like a crown, a curious middle-line process jutting out just above the nostrils. Above this process the crown-like portion of the leaf is extensively honeycombed and sculptured as in Figure 308. A line of rounded tubercles marks the upper and lower tips; in the lower tip the tubercles are limited to the middle portion only.

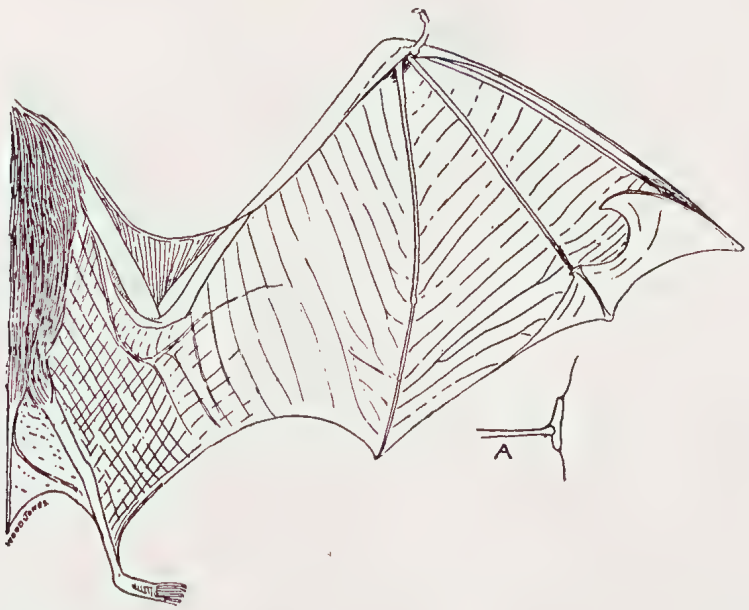

FIGURE 309.—*Rhinonycteris aurantia*. Wing membrane showing main membrane markings. Natural size. A is an enlarged view of the termination of the fourth digit.

The rest of the face is hairy. The eyes are very small and black; pale eyelashes are present on both lids. General body fur fine and silky. Individual hairs of the mid-dorsal region average 8 mm.; colour uniform throughout their length. Dorsal surface of the body somewhat darker golden yellow than the ventral surface. Membranes yellowish brown; limbs pinkish yellow. Propatagium narrow, the free edge crossing the radius at about the middle of its length and passing onwards as a well-developed fold which joins the metacarpo-phalangeal joint of the first digit.

Markings of patagium as in Figure 309. Third digit with the terminal phalanx sickle-shaped. Fourth digit with the terminal phalanx ending in a cross bar with equal limbs. Patagium attached to the tibia well above the ankle joint. Legs very long and thin. Foot long and narrow; all five digits equal and each composed of only two joints. Uropatagium narrow, from lower third of tibia. Calcaneal spur feebly developed. Tail of only five vertebrae; only the tip of the last joint free of the uropatagium.

The skull is of very peculiar and quite characteristic form. The cranial portion is raised above the facial portion and crested like a helmet, the crest terminating abruptly in front, some distance behind the interorbital constriction. (*See* Figure 310). The nasal portion of the skull is greatly swollen; the muzzle presenting two bilateral semitransparent swellings, one situated behind each of the large narial openings.

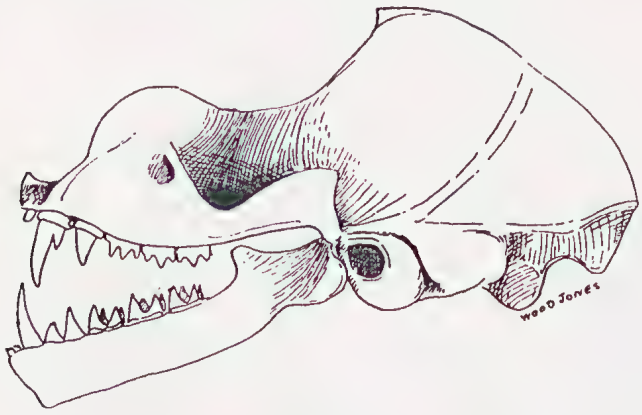

FIGURE 310.—*Rhinonycteris aurantia*. Lateral view of the skull of an adult female. Four times natural size.

In front of and between the nostrils is a prominent spur of the premaxilla. The premaxilla is united to the rest of the bones of the face by ligaments only and is freely movable. The bullae are relatively small. The palate is short and extends backwards but little behind the last molar teeth. The zygoma is unusually broad. The posterior angle of the lower jaw is strongly everted. The first upper premolars are minute teeth placed outside the general line of the tooth row. The upper incisors are small, rounded, and rudimentary. (*See* Figure 311.)

DIMENSIONS.

	Adult ♀
Head and body	47
Ear	13
Humerus	21
Radius	48
Digit I.	5·5
Digit III.	37
	12
	16
	32
Digit IV.	9
	8
	28
Digit V.	14
	10
Femur	17
Tibia	17
Foot	7
Tail	25

DIMENSIONS OF SKULL.

Length	15
Breadth	9
Constriction	2·5
Palate	6

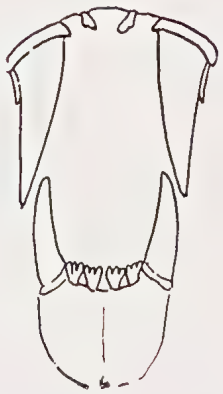

FIGURE 311.—*Rhinonycteris aurantia.* Anterior teeth of an adult female.

Of this very beautiful and characteristically Australian bat nothing seems to be known, save its mere description as a species. It occurs in South Australia, but appears to be very rare in this State, its habitat being usually said to be North and North-west Australia. It is one of the most remarkable of the peculiarly Australian evolutions among the Chiroptera.

The genus *Rhinonycteris* is confined to Australia and the Golden Horse-shoe Bat is the only member of its genus. It would therefore be a welcome addition to knowledge if our field naturalists could investigate the life history of this very peculiar Australian type.

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